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Outdoor Radon Study (1974-1975): An Evaluation of Ambient Radon-222 Concentrations in Grand Junction, CO

Office of Radiation Programs, Las Vegas, Nev

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OUTDOOR RADON STUDY (1974-1975) AN EVALUATION OF AMBIENT RADON-222 CONCENTRATIONS IN GRAND JUNCTION, COLORADO

APRIL 1977

U.S. ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF RADIATION PROGRAMS
LAS VEGAS FACILITY
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16. ABSTRACT

This report presents the results of measurements of ambient outdoor radon concentrations around the Grand Junction, Colorado, uranium mill tailings pile during the period of April 27, 1974 to April 2, 1975. A similar study was done by the U.S. Public Health Service in 1967 and 1968 before the pile was stabilized, and this study was done after the pile was stabilized to determine the effects of stabilization. Air samples were collected over a 48-hour period in a Mylar bag which was sent to the laboratory for radon analysis, using alpha scintillation cells. Samples were collected at each of 20 stations every three weeks for one year. The samples collected on the pile had higher radon concentrations following stabilization, and the exact cause for this is not known. Radon concentrations in the predominant daytime wind direction had elevated radon concentrations which are a power function with distance. Samples collected in other directions away from the pile contained background concentrations of radon.

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PREFACE

The Office of Radiation Programs of the U.S. Environmental Protection Agency carries out a national program designed to evaluate population exposure to ionizing and nonionizing radiation, and to promote development of controls necessary to protect the public health and safety. This report describes a survey conducted in Grand Junction, Colorado, to evaluate outdoor radon concentrations on and around the inactive uranium mill site located in Grand Junction. Readers of this report are encouraged to inform the Office of Radiation Programs of any omissions or errors. Comments or requests for further information are also invited.

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INTRODUCTION

Large volumes of solid and liquid wastes are produced during the uranium milling process since the uranium content of the ore is usually less than a few tenths of one percent. After crushing and chemical leaching, the waste volume will usually exceed the mill feed volume and these wastes contain essentially all of the naturally occurring radionuclides that were present in the ore, including small quantities of unremoved uranium. The radionuclides present occur in three natural decay chains headed by uranium-238, uranium-235, and thorium-232.

During the constant radioactive decay occurring in all of the three radionuclide chains, an inert or noble gas element named radon is formed. The isotopes formed are radon-219 called, historically, actinon from the uranium-235 chain; radon-220 called thoron from the thorium-232 chain; and radon-222 called radon from the uranium-238 chain.

Uranium-235 is normally present in very small quantities and the half-life of actinon (radon-219) is 4.0 seconds; thus, there will never be much actinon exhaled from the tailings material. Similarly, thoron (radon-220) also has a short half-life (55 seconds), so thoron would not diffuse very far through tailings material. The daughters of radon are particulates; thus, upon formation, they will be trapped in the tailings matrix. Because of the low abundance and very short half-lives, actinon and thoron are not normally considered to contribute significantly to the health effects calculated for uranium mining and uranium mill tailings. Should ores at a particular site contain significant quantities of thorium, it may be necessary to evaluate thoron levels.

Radon-222 has a relatively long half-life (3.8 days) and is formed by the decay of radium-226, a nuclide in the uranium-238 series. As the radon* is formed, a fraction (about 20 percent) of the total inventory emanates from the radium crystal and can migrate or diffuse to the surface of the tailings pile. Part of the 20 percent that is released from the tailings grains decays prior to diffusion to the surface of the pile. Thus, the actual radon release is reduced from the radon produced by radioactive decay both within the tailings grains and decay during transit within the pile. Atmospheric conditions and soil moisture content affect the rate of diffusion through the soil. The radon that escapes the surface of the tailings pile is said to be exhaled from the pile and is transported off-site with the surface winds.

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* Unless designated otherwise, radon will refer to the isotope radon-222.

The airborne radon will undergo radioactive decay in transit and produce short-lived decay products called radon-daughters. These daughters are called radium-A, radium-B, radium-C, and radium-C', (polonium-218, lead-214, bismuth-214, and polonium-214, respectively). They attach to other airborne particulate material and become a source of inhalation exposure to population groups residing in the uranium mill site vicinity.

Radon can diffuse through porous construction materials, into structures that are in the vicinity of the tailings pile. Low ventilation rates inside the structure allow the air to age (produce more radon-daughters by radioactive decay) and a higher working level* exposure will usually result inside the structure than in an ambient environment with the same radon concentration.

The alpha particle produced by the decay of radon only contributes about 0.3 percent of the total alpha energy; (Tsivouglou et al., 1953); thus, only the alpha energy from the radon-daughter decay is considered to produce a biological hazard. Even though radon does not contribute to the exposure, radon analysis provides a useful environmental screening technique. If 100 pCi of radon per liter of air are in equilibrium with its daughters, then the ultimate alpha decay energy produced will equal 1.3 x 10^5 MeV or 1 WL. Thus, if a WL guide is established, such as 0.01 WL, the guide cannot be exceeded unless the radon concentration exceeds 100 times the numerical value of the WL, i.e., 1 pCi/l. In this case, only those locations exceeding 1 pCi per liter radon would have to be sampled to determine the actual WL exposure.

A study conducted in Grand Junction, Colorado, by the U.S. Environmental Protection Agency, Office of Radiation Programs - Las Vegas Facility (ORP-LVF) and the Colorado Department of Health (CDH), was made to determine what effect, if any, stabilizing a tailings pile would have on local radon concentrations. This study involved the collection of post-stabilization radon samples at locations used in a previous study when the pile was unstabilized (U.S. Public Health Service, 1969). Additional samples were also collected during this study to further document radon concentrations near the pile. This report presents the results of this study, which was conducted during the period April 27, 1974 to April 9, 1975.

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* Working level (WL) is defined as any mixture of short half-life radon daughters in a liter of air which will ultimately produce 1.3 x 10^5 MeV of alpha decay energy.

BACKGROUND

In 1966, atmospheric concentrations of radon were measured in the vicinity of several uranium mill tailings piles. The sampling program, however, was not definitive due to the limited number of samples collected (U.S. Public Health Service, 1969). A larger joint study between the U.S. Public Health Service (PHS) and the U.S. Atomic Energy Commission (AEC) was begun in June 1967, in cooperation with the CDH and the Utah State Division of Health. The 1967 study evaluated the radon concentrations in the communities of Durango and Grand Junction, Colorado, and Monticello and Salt Lake City, Utah. The tailings pile in Monticello had been stabilized with a soil cover in 1961, and the other three piles were unstabilized.

Samples were collected from 13 on-pile and 44 off-pile stations in four communities and the following conclusions were stated in the report of the study (U.S. Public Health Service, 1969).

"1. The background radon-222 concentration at Grand Junction averages 0.83 pCi/liter and is approximately double the background concentration at the other three study sites." (Durango, 0.51 pCi/l; Monticello, 0.34 pCi/l; and Salt Lake City, 0.38 pCi/l)

"2. The tailings at the four study sites are not significantly affecting the atmospheric radon concentrations beyond a distance of one-half mile in the prevailing wind directions.

"3. Of the 44 off-pile stations, exclusive of Station 82 at Salt Lake City, only two exhibited an average radon concentration (above background) equal to or higher than the 1 pCi/liter screening value adopted for this study.

"4. The measured concentrations of radon over the stabilized tailings at Monticello are less than those over the other tailings in this study. Determination of the precise effect of stabilization would require sampling before and after stabilization at a specific site."

Based upon the above conclusions, the following general conclusions were also stated in the report (U.S. Public Health Service, 1969).

"1. A technique for taking integrated air samples for radon near uranium tailings piles has been developed, tested, and proven through use in the field.

"2. Atmospheric concentrations of radon in areas near uranium tailings piles have been evaluated as an index to radiation exposure of the population. The results indicate no significant radiation exposure to the public from this source.

"3. Stabilization and covering of tailings piles in theory should reduce the emanation of radon from the piles; however, the evidence for this is not conclusive from data obtained during this study.

"4. Development of point recommendations to control public exposure to radon from uranium tailings piles is not necessary, as no significant public exposure was indicated by the results of the study."

Since the completion of the above study in 1968, the CDH, The PHS, the U.S. Environmental Protection Agency (EPA), and the AEC (now the U.S. Energy Research and Development Administration [ERDA]) have conducted additional studies and surveys in Grand Junction, Colorado. These studies involved the detection and location of tailings use in and around structures; the evaluation of biological hazards from tailings use; and the evaluation of remedial actions required to eliminate any hazards existing because of tailings use (Congress of the United States, 1971; Culot, 1973; and Olson, et al., 1974).

The AMAX Uranium Company (a unit of American Metals Climax, Incorporated), the operational owner of the Grand Junction mill site, submitted a stabilization plan for the mill site to the State of Colorado in 1970. This plan was approved and the contouring and stabilization of the pile with six inches of clean soil was completed in 1970. An irrigation system was installed on the pile, the covered surface was seeded, and the area was irrigated during the summers of 1971 and 1972 (U.S. Atomic Energy Commission, 1974).

In November 1971, the CDH requested assistance from the EPA for conducting a joint study to determine the radon levels around the AMAX stabilized pile and compare those levels to the levels existing before stabilization.

CONCLUSIONS

1. The original 1967 Public Health Service study concluded that the background radon concentration in Grand Junction was higher than the backgrounds at the other three sites (Durango, Monticello, and Salt Lake City). The mean of the ambient radon concentrations at sampling locations away from the pile in Grand Junction (0.74 pCi/l) for the present study is not statistically different from the 1968 study.

2. The mean annual radon concentration measured above the tailings pile after stabilization is three times higher than before stabilization.

3. In the present study radon concentrations above background were measured only at stations in the predominant daytime wind direction. Station No. eight, which is at the end of the pile in the drainage wind direction, is an exception. The results from the other off-pile stations were not statistically different from background.

4. In the predominant daytime wind direction, there was a significant power curve relationship of radon concentrations to distance out to about one and one-half miles from the center of the tailings pile. This conclusion, which is based on a statistical analysis of combined data from both the 1968 and the 1975 studies, is different from the conclusion reached in the 1968 study report, where it was concluded that radon levels were not elevated further than one-half mile from the tailings pile.

5. Proper stabilization and maintenance of a tailings pile will usually prevent the tailings from being eroded by wind and water, and decrease the gamma radiation from the pile; but stabilization as currently practiced does not necessarily decrease the radon exhalation from the pile. Therefore, any development near a uranium mill tailings pile should take into account the possibility of an increase in the measured radon concentrations if the pile is not stabilized at the time of development.

6. Stabilization, specifically for radon, may be necessary to minimize unnecessary radiation exposures to persons living or working near present inactive uranium mill tailings piles.

DESCRIPTION OF STUDY

SAMPLING LOCATIONS

The study was designed to allow comparison of the radon concentration from this study with the radon concentration collected during the original 1968 Public Health Service study. Therefore, as many as possible of the sampling locations used in the previous study were incorporated into this study. Additional close-in stations were also selected. Permission to sample at twenty locations was obtained by the CDH. These sampling locations are shown in Figure 1 and listed in Table 1. Five of these stations were installed directly on the pile at the same locations used in the previous study and the electricity and installation were provided by the AMAX Company. One station (Number 6) was located about one-quarter mile north of the center of the pile; five stations (Numbers 8, 11, 12, 16, and 17) were located between one-quarter and one-half mile from the center of the pile; six stations (Numbers 7, 10, 15, 18, 19, and 20) were located between one-half and one mile from the center of the pile; and the remaining three stations (Numbers 9, 13, and 14) were located further than one mile from the center of the pile.

SAMPLING TECHNIQUES AND FREQUENCY

The sampling system used for this study was essentially the same as that used for the original Public Health Service study. A few of the original samplers were available, but were not operational, and new samplers were fabricated. The sampler consisted of an air mover which pumped air at a constant flow rate into a flexible 30-liter bag. This sampler was housed in a plywood shed which was large enough to also hold the bag and its cardboard shipping box. The complete sampling station is shown in Figure 2.

The air mover was a small diaphragm-type aquarium aerator pump which was sealed inside a plastic case with holes for the intake and the outlet (Figure 3). The encased pump was mounted on the inside of the lid of the plywood box. An in-line filter was screwed into the intake hole of the encased pump and a rubber tube (surgical tubing) was connected to the filter and the other end was routed outside the box with the open end about three feet above the ground. A precision needle valve was fitted to the outlet of the pump and the inlet of the bag was connected directly to the valve. The bag was therefore suspended

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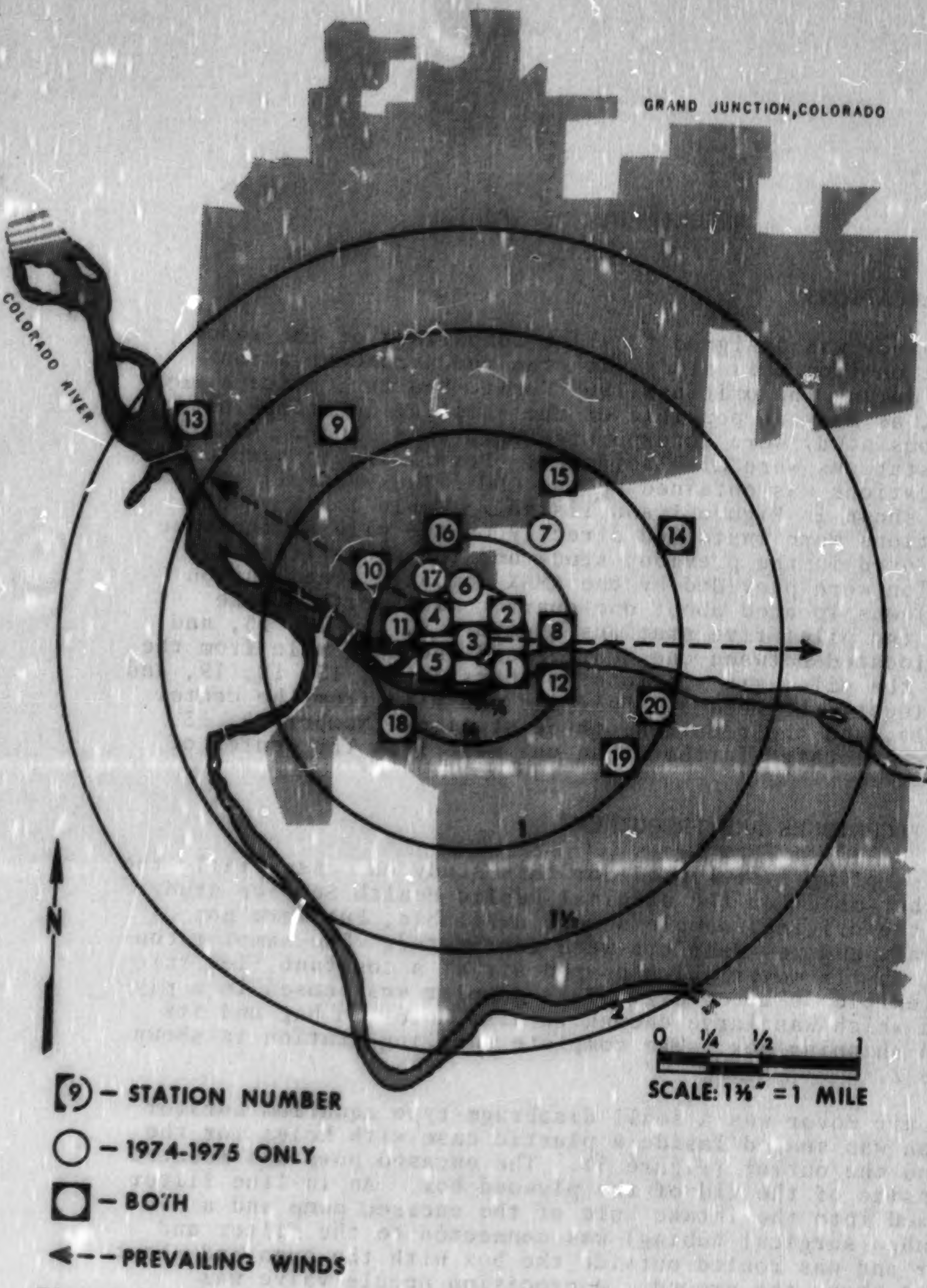
GRAND JUNCTION, COLORADO
COLORADO RIVER
13
9
15
16
7
14
10
17
6
11
4
2
8
3
5
1
12
20
18
19
½
1
1½
2
N
0
¼
½
1
SCALE: 1⅜" = 1 MILE
9 – STATION NUMBER
○ – 1974-1975 ONLY
▢ – BOTH
←--- PREVAILING WINDS

Figure 1. Station number and location of radon sampling stations

TABLE 1. OUTDOOR RADON STUDY SAMPLING STATIONS

Station Number	Location	Distance and Direction from Center of Pile	1975 Study Mean Radon Conc. (pCi/1)	1968 PHS Study Mean Radon Conc. (pCi/1)	1968 PHS Study Old Station Number
1	SE Corner, Climax Tailings Pile	---	30	---[a]	---[a]
2	NE Corner, Climax Tailings Pile	---	22	---	---
3	Center, Climax Tailings Pile	---	15	4.7	12
4	SW Corner, Climax Tailings Pile	---	38	---	---
5	NW Corner, Climax Tailings Pile	---	26	11	11
6	1005 Winters Avenue	1/4 N	6.5	---	---
7	567 S. 15th Street	5/8 NE	1.3	---	---
8	347 27 1/2 Road	3/8 E	1.6	1.1	16
9	241 N. 4th Street	1-1/4 NW	0.63	0.75	32
10	645 E. 4th Avenue	5/8 WNW	2.0	1.8	33
11	805 Struthers Avenue	3/8 W	7.2	3.4	23
12	318 27 3/8 Road (b)	1/2 SE	0.95	0.78	24
13	325 West Avenue (b)	1-3/4 WNW	0.77	0.69	41
14	2795 D. Road	1-1/8 ENE	0.89	0.88	36
15	1600 Ute Avenue	3/4 NNE	0.59	0.77	21
16	606 S. 9th Street	1/2 NNW	1.1	1.3	22
17	1000 S. 9th Street	3/8 NW	3.0	---	---
18	1761 Palisade Street	5/8 SSW	0.82	0.84	25
19	287 Mountain View Street (b)	3/4 SE	0.63	0.82	26
20	2785 Laguna Drive	3/4 ESE	0.61	0.88	35
	309 Pitkin Avenue	1-1/4 WNW	---	1.1	31
	2005 N. 17th Street	2 NNE	---	0.84	34
	961 Chipeta (b)	1-1/4 NW	---	0.70	42
	469 Sherwood Drive (b)	2 NW	---	0.78	43
	ABC Compound Redlands	1-1/2 SW	---	1.1	44
	428 28 Road	1-3/4 NE	---	0.82	45
	172 Shamrock (b)	---	---	0.74	46
	Special Background Station	5 N	---	0.79	47

(a) Unable to correlate station location and number from original report, except for Stations 3 and 5

(b) No tailings on property

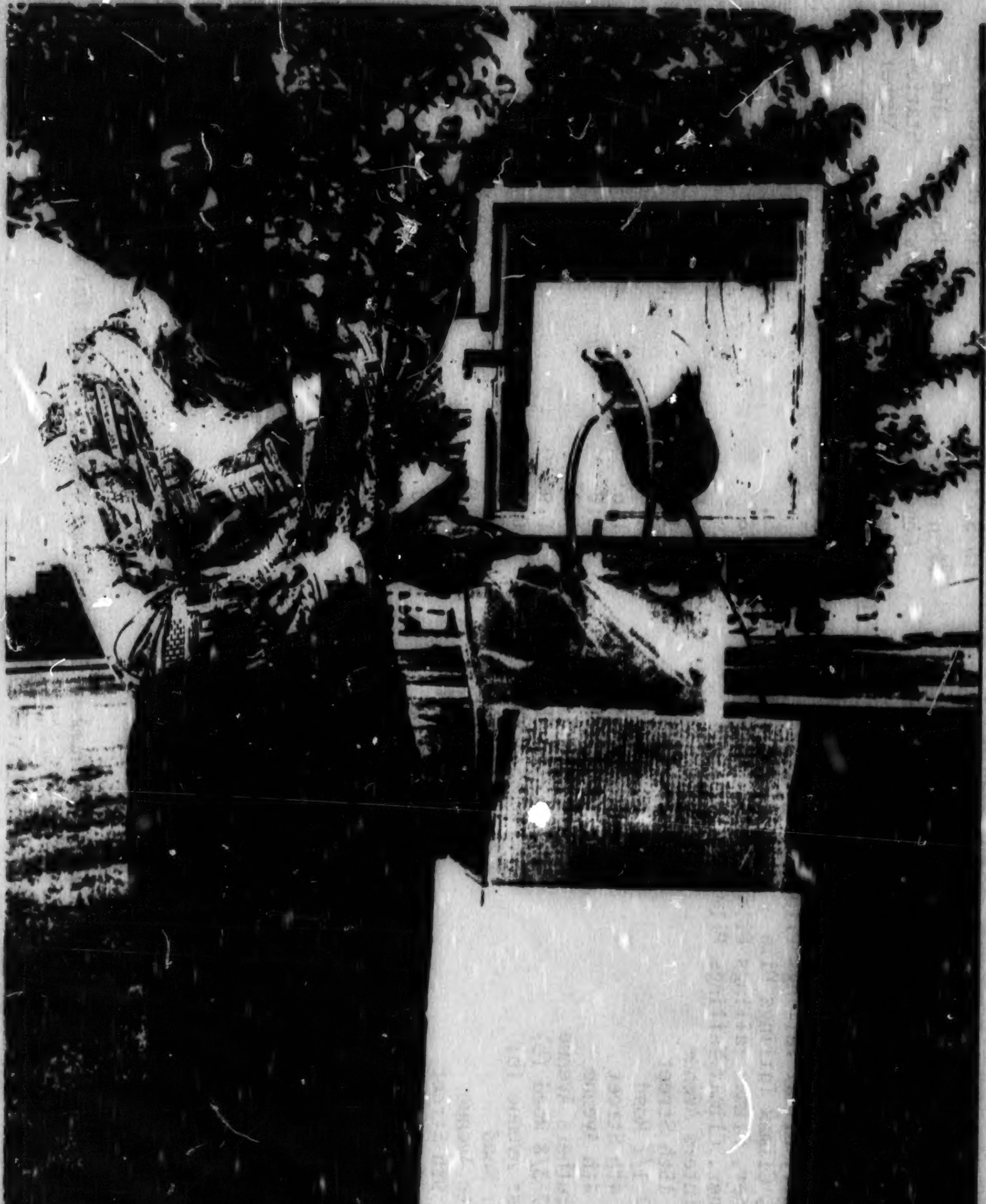

Figure 2. Sampling equipment for the outdoor radon collection stations

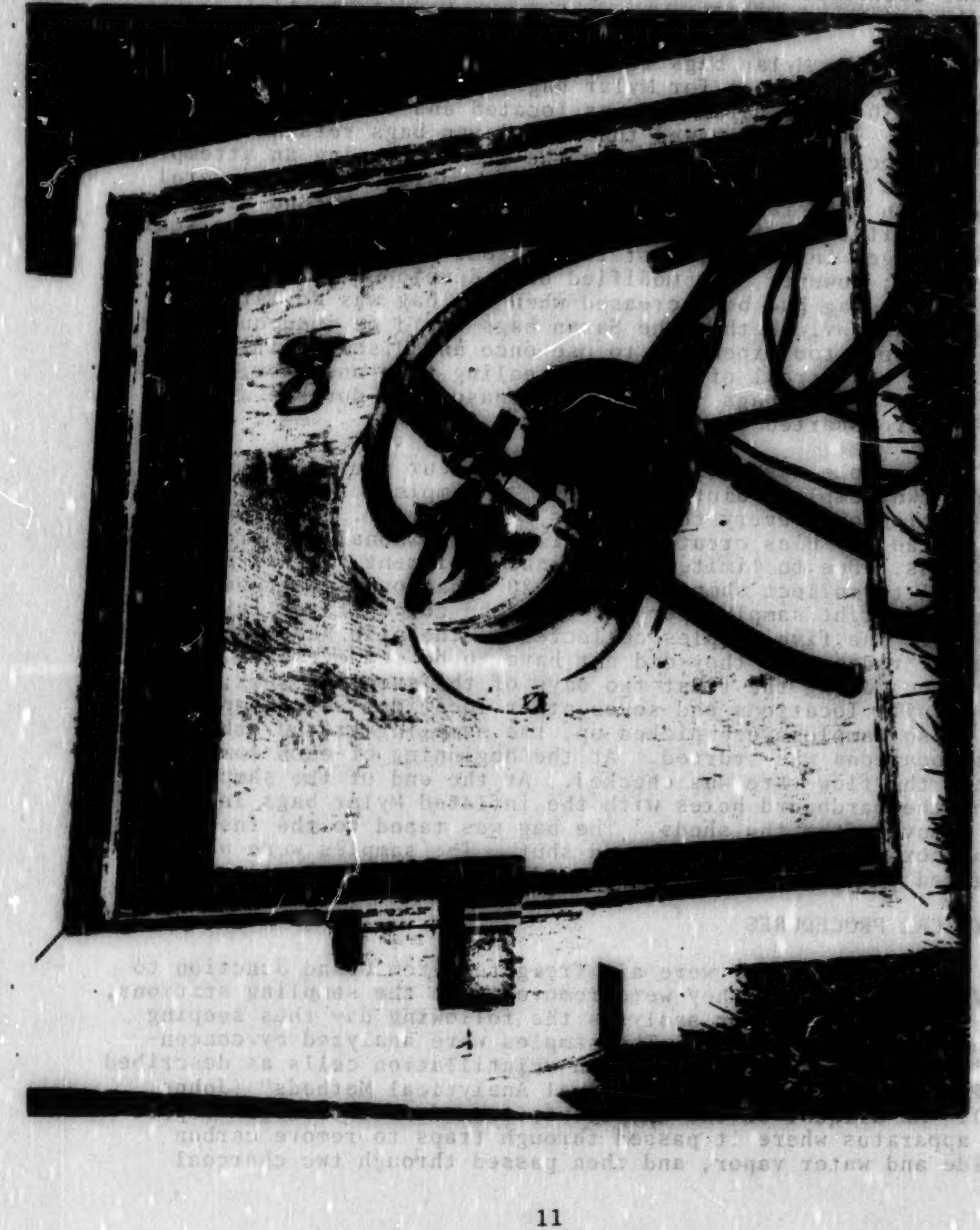

Figure 3. Outdoor radon sampler

from the pump, and as the lid was placed on the box, the bag slid down inside the cardboard shipping box. The flow rate of the pump was calibrated by water displacement and the needle valve was adjusted to give a flow rate of approximately 6 ml/min.

None of the Mylar bags from the original study were available and a commercial outlet for Mylar bags could not be located. A substitute 30-liter Saran bag was located and several were ordered for testing. Testing showed that the Saran bags retained radon, so it was decided to use them for the study. During an attempt to start the study in September 1972, it was found that several of the Saran bags failed to hold air when used a second time. After consultation with the manufacturer, it was decided to seal all four edges instead of just folding one edge and sealing the other three; however, the modified bags developed pinhole leaks wherever the bag had been creased when the bag was deflated. Since it was obvious that the Saran bags would be inadequate for reuse and were too expensive to use once and discard, it was decided to buy a roll of Mylar and sealing tape and fabricate the Mylar bags. These bags proved to be reasonably durable and the study was re-started in April 1974.

Each sample was collected over a 48-hour period in order to include two complete diurnal cycles. A sample was collected at each station once every three weeks for one year. This was done to minimize any bias created by daily and seasonal meteorological variations. Due to limited analytical equipment, it was not practical to collect samples at all 20 locations simultaneously since only eight samples per day could be concentrated for analysis. The five samples collected on the pile had high enough levels of radon that they did not have to be concentrated. Therefore, during the first two days of the sampling week, the five on-pile locations and seven other locations were sampled. When these samples were picked up, the sampling at the other eight locations was started. At the beginning of each sampling period, the flow rate was checked. At the end of the sampling period the cardboard boxes with the inflated Mylar bags inside, were removed from the sheds. The bag was taped to the inside of the box and the box was taped shut. The samples were air freighted to Las Vegas on the same day that they were picked up.

ANALYTICAL PROCEDURES

Since the samples were air freighted from Grand Junction to Las Vegas on the day they were removed from the sampling stations, they were available for analysis the following day thus keeping radon decay to a minimum. The samples were analyzed by concentrating the radon and counting in scintillation cells as described in EPA's "Handbook of Radiochemical Analytical Methods" (Johns, 1975). An aliquot of the sample was transferred to a gas separation apparatus where it passed through traps to remove carbon dioxide and water vapor, and then passed through two charcoal traps at dry ice-acetone temperature to collect the radon. After the sample had passed through the apparatus, the dry ice-acetone (-80°C) bath was removed from the traps and a furnace preheated to 350°C was put around the traps. The radon was then emanated from the traps with helium and collected in scintillation cells. The radon and daughters were allowed to reach equilibrium (approximately 4-1/2 hours) and then the cell was counted for 30 minutes. The samples from the pile contained radon concentrations high enough to allow an aliquot of the sample to be transferred directly into the scintillation cells. The radon was allowed to reach equilibrium with its daughters, and then the cell was counted on a photomultiplier tube for thirty minutes. The counting and sampling information were coded for computer processing. The computer printout presents the radon concentration in pCi/l and also shows the two-sigma counting error (Appendix A). The air volumes were corrected for average ambient conditions in Grand Junction (638 mm Hg and 11°C).

RESULTS

This study included 17 sampling periods between April 27, 1974 and April 9, 1975. The September 1972 data that were collected while originally trying to get the study started were not included in this study, because of the desire to sample over one continuous year. During the seventeen sampling periods, 357 samples were collected at the 20 stations, but only 329 samples were analyzed because some of the bags leaked in transit or were lost in transit. In four cases, two samples were collected in the same sampling period; they were averaged, resulting in 325 data points. The complete data for each sample are listed in Appendix A.

The radon concentration of each sample and the mean annual radon concentration for each station are shown in Table 2. Eight stations had 17 samples to average for the annual mean, nine stations had 16 samples and the other three stations had only 15 samples. In Figure 4, the mean annual radon concentrations of these stations are also shown and compared to the 1967 concentration at the duplicated stations.

The 20 stations in this study have been combined into four groups which are shown in Table 3: (1) on-pile, (2) within one-half mile of pile, (3) between one-half mile and three-quarters mile of pile, and (4) more than three-quarters mile from the pile.

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TABLE 2. RADON ANALYTICAL SAMPLE RESULTS AND STATION MEANS (pCi/l) FOR THE 1974-1975 OUTDOOR RADON STUDY.

Sample Period	Year	Sample Start	Sample Stop	Station Number 1	2	3	4	5	6	7
1	1974	4/27	4/29	19	14	12		19	5.9	1.0
		4/29	5/01				43			
2		5/18	5/20	22	14	11	29	17	3.3	0.65
		5/21	5/23							
3		6/08	6/10	35	17	15	46	21	5.0	0.75
		6/10	6/12							
4		6/24	6/26							
		6/28	6/30	27	16	20	39	NS(b)	9.9	1.6
		6/30	7/02							
		7/08	7/10							
5		7/20	7/22	15 (a)	24 (a)	NS	NS	NS	2.6	NS
		7/22	7/24	29	24					
		7/24	7/26	24	23	16	26	23		0.56
6		8/06	8/08							
		8/10	8/12	21	19	9.7	27	18		0.28
		8/12	8/14						3.7	
		8/19	8/21							
7		9/01	9/03	25	25	14	NS	19	NS	0.96
		9/03	9/05							
		9/09	9/11						3.8	
8		9/21	9/23	53	41	19	66	38	13	2.9
		9/23	9/25							
		9/30	10/02							
9		10/13	10/15	NS	29	17	62	36	14	2.4
		10/15	10/17							
		10/21	10/23							
10		11/02	11/04	34	22	16	39	39	3.7	0.75
		11/04	11/06							
		11/11	11/13							
11		11/22	11/24	25	18	8.6	28	17	4.8	1.1
		11/24	11/26							
		12/02	12/04							
12		12/15	12/17	27	27	18	29	27	7.0	1.6
		12/31	1/02							
13	1975	1/04	1/06	36	20	20	NS	35	6.3	1.3
		1/07	1/09							
		1/14	1/16							
14		1/25	1/27	46	35	30	NS	52	14	2.9
		1/27	1/29							
		2/03	2/05				38			
15		2/16	2/18	47	22	16		27	5.6	1.1
		2/18	2/20							
		2/24	2/26				42			
16		3/08	3/10	11	9.7	8.5		8.2	0.71	0.48
		3/10	3/12							
		3/17	3/19				34			
17		3/29	3/31	37	19			25	8.1	1.6
		3/31	4/02							
		4/07	4/09			9.6	18			
Number of Samples				16	17	17	15	16	17	17
Mean ± 1 Sigma Error				30 ± 12	22 ± 7.9	15 ± 5.5	38 ± 13	26 ± 11	6.5 ± 4.0	1.3 ± 0.80
Percent Variance				40	36	37	34	42	62	62

(a) Average used for samples collected in same sampling period.

(b) NS - No sample

TABLE 2. (continued) RADON ANALYTICAL SAMPLE RESULTS AND STATION MEANS (pCi/l) FOR THE 1974-1975 OUTDOOR RADON STUDY.

				Station Number						
Sample Period	Year	Sample Start	Sample Stop	8	9	10	11	12	13	14
1	1974	4/27	4/29	1.2	0.21	1.3	4.7	0.62		
		4/29	5/01						0.41	0.98
2		5/12	5/20	0.86	NS (b)	0.87	3.1	0.46		
		5/21	5/23						0.89	NS
3		6/08	6/10	0.66	0.56	2.4	7.1	0.81		
		6/10	6/12						1.1	0.85
4		6/24	6/26							
		6/28	6/30	1.1	0.49	3.4	9.3	0.77		
		6/30	7/02						0.32	0.63
		7/08	7/10							
5		7/20	7/22	0.39	0.39	NS	NS	0.68		
		7/22	7/24						0.24	
		7/24	7/26				3.6			0.38
6		8/06	8/08			1.2				
		8/10	8/12	0.57	0.52	0.80 (a) 1.0	3.6	0.47	NS	
		8/12	8/14							
		8/19	8/21							2.1
7		9/01	9/03	0.95	NS	1.4	3.3	0.51		
		9/03	9/05						NS	0.61
		9/09	9/11		0.49				0.46	
8		9/21	9/23		1.4	NS	17	1.6		
		9/23	9/25						0.80	0.52
		9/30	10/02	0.89		5.3				
9		10/13	10/15	1.9			11			
		10/15	10/17						1.5	0.75
		10/21	10/23		0.50	NS		0.90		
10		11/02	11/04	1.9	0.58	0.97	11	1.5		
		11/04	11/06						0.96	0.85
		11/11	11/13							
11		11/22	11/24	1.1	0.68	1.7	5.6	0.82		
		11/24	11/26						1.7	1.9
		12/02	12/04							
12		12/15	12/17	2.2	0.78	2.2	7.1	0.91		
		12/31	1/02						0.93	1.2
13	1975	1/06	1/06	4.1	0.77	2.0	6.7	1.6		
		1/07	1/09						NS	1.0
		1/14	1/16						1.5	
14		1/25	1/27	3.8	1.4	2.8	13	2.0		
		1/27	1/29						0.37	0.53
		2/03	2/05							
15		2/16	2/18	2.6	0.28		5.8	1.1		
		2/18	2/20						0.46	0.89
		2/24	2/26			3.6				
16		3/08	3/10	0.63	0.43	0.43		0.44		
		3/10	3/12				1.2		0.41	NS
		3/17	3/19							0.49
17		3/29	3/31	1.7	0.53		8.9	1.0		
		3/31	4/02			0.68			0.24	0.54
		4/07	4/09							
Number of Samples				17	16	15	17	17	16	16
Mean ± 1 Sigma Error				1.6 ± 1.1	.63 ± 0.34	2.0 ± 1.3	7.2 ± 4.1	.95 ± .46	.77 ± .48	.89 ± .49
Percent Variance				69	54	65	57	48	62	55

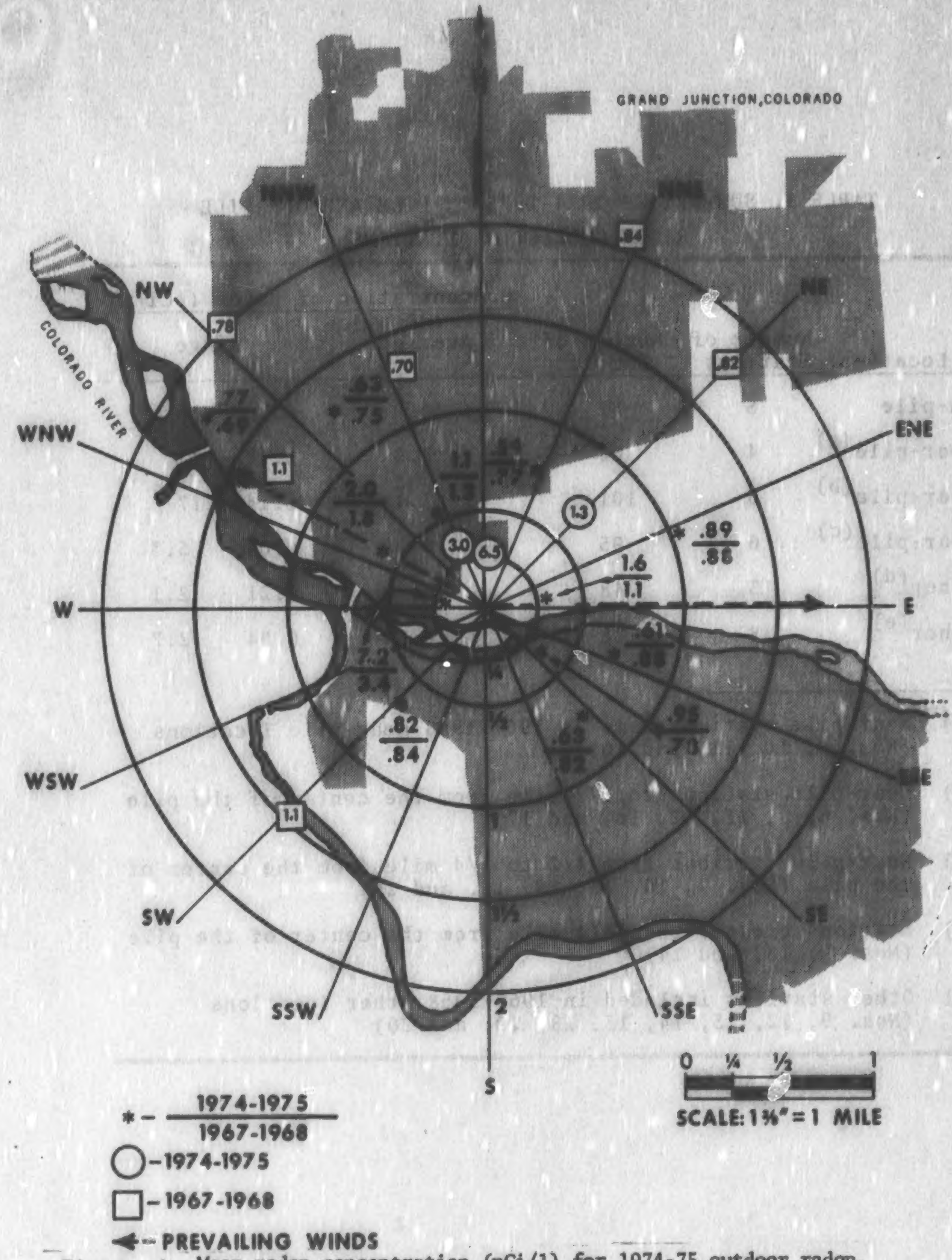
(a) Average used for samples collected in same sampling period.
(b) NS - No sample

TABLE 2. (continued) RADON ANALYTICAL SAMPLE RESULTS AND STATION MEANS (pCi/l) FOR THE 1974-1975 OUTDOOR RADON STUDY.

Sample Period	Year	Sample Start	Sample Stop	Station Number 15	16	17	18	19	20
1	1974	4/27	4/29						
		4/29	5/01	0.90	1.4	3.7	NS[b]	0.67	0.93
2		5/18	5/20						
		5/21	5/23	0.51	1.8	6.0	0.50	0.036	0.57
3		6/08	6/10						
		6/10	6/12	0.56	0.90	3.1	0.82		0.54
4		6/24	6/26					0.43 (a) 0.38	
		6/28	6/30						
		6/30	7/02	0.46	0.54	2.6		0.34	0.31
		7/08	7/10				0.70		
5		7/20	7/22						
		7/22	7/24		0.45	1.2			
		7/24	7/26	0.46			0.48	0.45	0.36
6		8/06	8/08						
		8/10	8/12						
		8/12	8/14	0.55	0.74	2.4	0.50	0.39	0.50
		8/19	8/21						
7		9/01	9/03						
		9/03	9/05	NS	1.1			0.67	NS
		9/09	9/11	0.35		2.2	0.92		
8		9/21	9/23						
		9/23	9/25	0.53	0.86	4.0		0.89	0.49
		9/30	10/02				0.54		
9		10/13	10/15						
		10/15	10/17		1.8		0.96	0.96	
		10/21	10/23	0.66		3.3			0.56
10		11/02	11/04						
		11/04	11/06				1.2	0.43	
		11/11	11/13	1.3	2.7	5.2			1.1
11		11/22	11/24						
		11/24	11/26	0.044		7.6		1.2	1.1
		12/02	12/04		3.0		2.7		
12		12/15	12/17						NS
		12/31	1/02	0.90	1.2	NS	1.1	0.84	
13	1975	1/04	1/06						
		1/07	1/09	NS	NS	1.2	0.94	0.97	0.62
		1/14	1/16		0.14				
14		1/25	1/27						
		1/27	1/29	NS	1.1	1.4	0.40	0.63	0.43
		2/03	2/05	0.56					
15		2/16	2/18						
		2/18	2/20	0.70	0.84	2.1	0.80	0.67	0.67
		2/24	2/26						
16		3/08	3/10						
		3/10	3/12	0.44	0.55	1.1	0.33	0.49	
		3/17	3/19						0.60
17		3/29	3/31	0.46					
		3/31	4/02		0.20	1.0	0.27	0.46	0.39
		4/07	4/09						
Number of Samples				16	17	16	16	16	15
Mean ± 1 Sigma Error				.59 ± .28	1.1 ± .80	3.0 ± 1.9	.82 ± .57	.63 ± .29	.61 ± .25
Percent Variance				47	73	63	70	46	41

(a) Average used for samples collected in same sampling period.

(b) NS - No sample


GRAND JUNCTION,COLORADO
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1
SCALE: 1⅜" = 1 MILE
* – 1974-1975 / 1967-1968
○ – 1974-1975
□ – 1967-1968
PREVAILING WINDS

Figure 4. Mean radon concentration (pCi/l) for 1974-75 outdoor radon study and 1967-68 U.S. Public Health Service (USPHS) study

TABLE 3. SUMMARY OF 1974-1975 ON-PILE AND OFF-PILE RADON COLLECTION STATIONS

Location	Number of Stations	Number of Samples	Concentration of Radon (pCi/l)	
			Average	Range
On-pile	5	81	26	8.2 - 66
Near-pile[a]	4	66	3.0	0.14 - 17
Near-pile[b]	6	101	3.4	0.14 - 17
Near-pile[c]	6	95	0.99	0.04 - 5.3
Other[d]	3	48	0.76	0.21 - 2.1
Other[e]	8	128	0.74	0.04 - 2.7

(a) Near-pile stations same as 1967-1968 near-pile locations (Nos. 8, 10, 11, and 16)

(b) Near-pile stations to 1/2 mile from the center of the pile (Nos. 6, 8, 11, 12, 16, and 17)

(c) Near-pile stations from 1/2 to 3/4 mile from the center of the pile (Nos. 7, 10, 15, 18, 19, and 20)

(d) Stations greater than 3/4 mile from the center of the pile (Nos. 9, 13, and 14)

(e) Other stations included in 1967-1968 other locations (Nos. 9, 12, 13, 14, 15, 18, 19, and 20)

DISCUSSION

SAMPLING TECHNIQUE

In general, the sampling technique was good, but a number of bags failed during the study. The failures occurred either during sampling or during transit. In either case, an attempt was made to collect another sample from the station where the sample was lost. This was not possible in all instances, but no station had less than fifteen samples to average for the annual mean radon concentration.

STATION RESULTS

The data from each station for each year were plotted on normal probability plots of distribution. From these plots it was decided that the data are best described as following a log-normal statistical distribution, which is consistent with the findings on radioisotopic data. Since most statistical tests assume normal distribution, it was necessary to use the logarithms of the radon values in the tests.

The data were analyzed using the analysis of variance and covariance (Kinnison, 1976). The analysis of variance is a general purpose statistical technique that tests for the existence of any unknown pattern of responses within a data set.

The first analysis of variance test considered all the data from all the stations for both years, and showed a significant difference between the data for the years of 1968 and 1975, a significant difference between stations, and a significant interaction. Further tests were conducted on sub-groups created by separating the data into on-pile and off-pile groups, in order to find the source of interaction.

The analysis of variance of the on-pile stations showed a significant increase in radon levels from 1968 to 1975, and a significant difference between the on-pile stations. The mean annual radon concentration for the five on-pile stations was 26 pCi/1 for 1975 (Table 3) compared to 7.8 pCi/1 for 1968 (Table 4). The exact cause of this increase of radon concentration by a factor of three after stabilization of the pile cannot be determined. In addition to the stabilization of the pile, a number of changes affecting the tailings pile had occurred between the original study and this study. Before the pile was stabilized, it was re-contoured which could have changed the distribution of the tailings and high radium content slimes in the pile, the depth of tailings, and the surface area of the pile. During the original study, the mill was active and portions of the surface of the pile were covered by a pond; but during this study, the only moisture the pile received was natural precipitation and occasional irrigation. The roots of the vegetation used to cover the pile probably penetrated the soil cover and went into the tailings, thus creating channels for radon movement. During the period of this survey, tailings which had been removed from homes as part of the remedial action and ongoing building permit program were brought back to the millsite and placed in a repository at the east end of the stabilized tailings pile. The volume of these tailings was small compared to the original pile, and probably did not contribute significantly to the observed radon levels.

Any or all of these changes could account for some of the increased levels of radon detected on the pile during the second study. It is not possible to determine exactly what caused the increased radon levels, but the most likely cause appears to be the decreased moisture content of the pile which would change the diffusion coefficient and allow more radon to diffuse to the surface.

The analysis of all of the data for the off-pile stations showed no significant differences in radon levels between 1968 and 1975, except for station number eleven. The same analysis showed that there were significant differences between stations. Station eleven is located very close to the end of the tailings pile in one of the major downwind directions. Since the radon concentrations on the pile increased significantly, it was logical that the close-in stations in the downwind direction would also have significantly increased radon concentrations as was the case with station eleven. As shown in Table 1, stations six and seventeen were close-in stations which had high radon concentrations during the 1975 study, but unfortunately they were not used in the 1968 study so no comparison can be made to see if the radon concentration increased.

Examination of the off-pile data suggested that the stations fell into groups depending upon compass direction and distance from the tailings pile. Several trial plots of the data suggested a linear relationship of radon concentrations to distance from the pile on log-log graph paper; this is equivalent to a power curve relationship. This relationship was incorporated into the analysis by including the logarithm of distance from the pile as a regression variable for the analysis of covariance.

The comparison of stations in different directions was done by dividing the stations into eight groups on the basis of 45-degree sectors from true north. This comparison showed that for the sectors from 0 to 270 degrees from north (clockwise) there was no power curve effect due to distance and the stations were considered as members of one population with a mean radon concentration of 0.71 pCi/liter. An exception is station number eight, which has radon concentrations greater than background. This station is very close to the end of the pile and lies in the direction of the drainage wind from the pile. The data from the two sectors from 270 to 360 degrees showed a significant power curve relationship of radon to distance. There was also a significant difference between the two sectors and also between the sectors and the other data. The power function extends to about one and one-half miles from the pile. This is in the downwind direction during the predominant daytime winds. Because of minimal data in the southerly direction, several sectors had to be combined for the analysis of covariance.

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APPENDIX A

SAMPLE COLLECTION AND ANALYSIS INFORMATION

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GRAND JCT COLORADO 222RN RESULTS

COLORADO              REPORTED  75/07/08
--------------------------------------ANALYSIS---RESULT----2SIGMA---UNIT

GRAND JCT COLO SE CORNER OF PILE              222RN       1.9E01     2.3E00   PCI/L
25 0240 077 05 8 97     2
130593 ODR01 001 (a)   ON- 04 27 74 0927
  SIZE-               OFF- 04 29 74 0925

GRAND JCT COLO SE CORNER OF PILE              222RN       2.2E01     2.4E00   PCI/L
25 0240 077 05 8 97     2
131409 ODR02 001       ON- 05 18 74 1030
  SIZE-               OFF- 05 20 74 0945

GRAND JCT COLO SE CORNER OF PILE              222RN       3.5E01     3.0E00   PCI/L
25 0240 077 05 8 97     2
131944 ODR03 001       ON- 06 08 74 1140
  SIZE-               OFF- 06 10 74 1140

GRAND JCT COLO SE CORNER OF PILE              222RN       2.7E01     3.1E00   PCI/L
25 0240 077 05 8 97     2
132585 ODR04 001       ON- 06 28 74 1440
  SIZE-               OFF- 06 30 74 1110

GRAND JCT COLO SE CORNER OF PILE              222RN       1.5E01     2.0E00   PCI/L
25 0240 077 05 8 97     2
133717 ODR05 001       ON- 07 20 74 1350
  SIZE-               OFF- 07 22 74 1140
```

(a) Station Number

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GRAND JCT COLORADO 222RN RESULTS

COLORADO                REPORTED  75/07/08
---------------------------------------------ANALYSIS---RESULT----2SIGMA---UNITS

GRAND JCT COLO SE CORNER OF PILE               222RN      2.4E01     2.5E00   PCI/L
25 0240 077 05 8 97     2
133233 ODR05 001        ON- 07 24 74 1350
  SIZE-                OFF- 07 26 74 1135

GRAND JCT COLO SE CORNER OF PILE               222RN      2.1E01     2.3E00   PCI/L
25 0240 077 05 8 97     2
133654 ODR06 001        ON- 08 10 74 1025
  SIZE-                OFF- 08 12 74 1125

GRAND JCT COLO SE CORNER OF PILE               222RN      2.5E01     2.6E00   PCI/L
25 0240 077 05 8 97     2
134185 ODR07 001        ON- 09 01 74 0935
  SIZE-                OFF- 09 03 74 1020

GRAND JCT COLO SE CORNER OF PILE               222RN      5.3E01     3.7E00   PCI/L
25 0240 077 05 8 97     2
134746 ODR08 001        ON- 09 21 74 1031
  SIZE-                OFF- 09 23 74 1008

GRAND JCT COLO SE CORNER OF PILE               222RN      3.4E01     2.9E00   PCI/L
25 0240 077 05 8 97     2
135477 ODR10 001        ON- 11 02 74 0835
  SIZE-                OFF- 11 04 74 0955

GRAND JCT COLO SE CORNER OF PILE               222RN      2.5E01     2.6E00   PCI/L
25 0240 077 05 8 97     2
141003 ODR11 001        ON- 11 22 74 0935
  SIZE-                OFF- 11 24 74 0935

GRAND JCT COLO SE CORNER OF PILE               222RN      2.7E01     2.7E00   PCI/L
25 0240 077 05 8 97     2
141401 ODR12 001        ON- 12 15 74 0925
  SIZE-                OFF- 12 17 74 1015

GRAND JCT COLO SE CORNER OF PILE               222RN      3.6E01     3.1E00   PCI/L
25 0240 077 05 8 97     2
141701 ODR13 001        ON- 01 04 75 1010
  SIZE-                OFF- 01 06 75 0935

GRAND JCT COLO SE CORNER OF PILE               222RN      4.6E01     3.5E00   PCI/L
25 0240 077 05 8 97     2
142301 ODR14 001        ON- 01 25 75 0950
  SIZE-                OFF- 01 27 75 1010

GRAND JCT COLO SE CORNER OF PILE               222RN      4.7E01     3.5E00   PCI/L
25 0240 077 05 8 97     2
142901 ODR15 001        ON- 02 16 75 1010
  SIZE-                OFF- 02 18 75 1130
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GRAND JCT COLORADO 222RN RESULTS

COLORADO               REPORTED  75/07/08
---------------------------------------ANALYSIS---RESULT----2SIGMA---UNI

GRAND JCT COLO SE CORNER OF PILE          222RN      1.1E01    1.7E00   PCI/L
25 0240 077 05 8 97     2
143201 ODR16 001       ON- 03 08 75 0955
  SIZE-               OFF- 03 10 75 1210

GRAND JCT COLO SE CORNER OF PILE          222RN      3.7E01    3.1E00   PCI/L
25 0240 077 05 8 97     2
144001 ODR17 001       ON- 03 29 75 1040
  SIZE-               OFF- 03 31 75 1040

GRAND JCT COLO NE CORNER OF PILE          222RN      1.4E01    2.0E00   PCI/L
25 0240 077 05 8 97     2
130594 ODR01 002       ON- 04 27 74 0948
  SIZE-               OFF- 04 29 74 0932

GRAND JCT COLO NE CORNER OF PILE          222RN      1.4E01    1.9E00   PCI/L
25 0240 077 05 8 97     2
131410 ODR02 002       ON- 05 18 74 1043
  SIZE-               OFF- 05 20 74 0954

GRAND JCT COLO NE CORNER OF PILE          222RN      1.7E01    2.1E00   PCI/L
25 0240 077 05 8 97     2
131945 ODR03 002       ON- 06 08 74 1145
  SIZE-               OFF- 06 10 74 1150

GRAND JCT COLO NE CORNER OF PILE          222RN      1.6E01    2.0E00   PCI/L
25 0240 077 05 8 97     2
132492 ODR04 002       ON- 06 28 74 1445
  SIZE-               OFF- 06 30 74 1145

GRAND JCT COLO NE CORNER OF PILE          222RN      2.4E01    2.4E00   PCI/L
25 0240 077 05 8 97     2
133218 ODR05 002       ON- 07 20 74 1400
  SIZE-               OFF- 07 22 74 1145

GRAND JCT COLO NE CORNER OF PILE          222RN      2.3E01    2.3E00   PCI/L
25 0240 077 05 8 97     2
133236 ODR05 002       ON- 07 24 74 1355
  SIZE-               OFF- 07 26 74 1140

GRAND JCT COLO NE CORNER OF PILE          222RN      1.9E01    2.2E00   PCI/L
25 0240 077 05 8 97     2
133655 ODR06 002       ON- 08 10 74 0930
  SIZE-               OFF- 08 12 74 1055

GRAND JCT COLO NE CORNER OF PILE          222RN      2.5E01    2.6E00   PCI/L
25 0240 077 05 8 97     2
134186 ODR07 002       ON- 09 01 74 0930
  SIZE-               OFF- 09 03 74 0950
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GRAND JCT COLORADO 222RN RESULTS

COLORADO                 REPORTED  75/07/08
-----------------------------------------------ANALYSIS---RESULT----2SIGMA---UNIT

GRAND JCT COLO NE CORNER OF PILE               222RN      4.1E01    3.3E00   PCI/L
25 0240 077 05 8 97     2
134747 ODR08 002        ON- 09 21 74 1052
  SIZE-                OFF- 09 23 74 0957

GRAND JCT COLO NE CORNER OF PILE               222RN      2.9E01    2.7E00   PCI/L
25 0240 077 05 8 97     2
135136 ODR09 002        ON- 10 13 74 1000
  SIZE-                OFF- 10 15 74 1035

GRAND JCT COLO NE CORNER OF PILE               222RN      2.2E01    2.4E00   PCI/L
25 0240 077 05 8 97     2
138478 ODR10 002        ON- 11 02 74 0850
  SIZE-                OFF- 11 04 74 1005

GRAND JCT COLO NE CORNER OF PILE               222RN      1.8E01    2.2E00   PCI/L
25 0240 077 05 8 97     2
141004 ODR11 002        ON- 11 22 74 0925
  SIZE-                OFF- 11 24 74 0940

GRAND JCT COLO NE CORNER OF PILE               222RN      2.7E01    2.7E00   PCI/L
25 0240 077 05 8 97     2
141402 ODR12 002        ON- 12 15 74 0915
  SIZE-                OFF- 12 17 74 1020

GRAND JCT COLO NE CORNER OF PILE               222RN      2.0E01    2.3E00   PCI/L
25 0240 077 05 8 97     2
141702 ODR13 002        ON- 01 04 75 1000
  SIZE-                OFF- 01 06 75 0940

GRAND JCT COLO NE CORNER OF PILE               222RN      3.5E01    3.0E00   PCI/L
25 0240 077 05 8 97     2
142302 ODR14 002        ON- 01 25 75 0940
  SIZE-                OFF- 01 27 75 1000

GRAND JCT COLO NE CORNER OF PILE               222RN      2.2E01    2.4E00   PCI/L
25 0240 077 05 8 97     2
142902 ODR15 002        ON- 02 16 75 1000
  SIZE-                OFF- 02 18 75 1135

GRAND JCT COLO NE CORNER OF PILE               222RN      9.7E00    1.6E00   PCI/L
25 0240 077 05 8 97     2
143202 ODR16 002        ON- 03 08 75 0945
  SIZE-                OFF- 03 10 75 1215

GRAND JCT COLO NE CORNER OF PILE               222RN      1.9E01    2.3E00   PCI/L
25 0240 077 05 8 97     2
144002 ODR17 002        ON- 03 31 75 1045
  SIZE-                OFF- 03 31 75 1045
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GRAND JCT COLORADO 222RN RESULTS

COLORADO                  REPORTED  75/07/08
----------------------------------------------ANALYSIS---RESULT----2SIGMA---UNITS

GRAND JCT COLO CENTER OF PILE                 222RN     1.2E01    1.0E00   PCI/L
25 0240 077 05 8 97     2
130595 ODR01 003        ON- 04 27 74 1005
  SIZE-                OFF- 04 29 74 0937

GRAND JCT COLO CENTER OF PILE                 222RN     1.1E01    1.6E00   PCI/L
25 0240 077 05 8 97     2
131411 ODR02 003        ON- 05 18 74 1052
  SIZE-                OFF- 05 20 74 1002

GRAND JCT COLO CENTER OF PILE                 222RN     1.3E01    1.9E00   PCI/L
25 0240 077 05 8 97     2
131946 ODR03 003        ON- 06 08 74 1155
  SIZE-                OFF- 06 10 74 1155

GRAND JCT COLO CENTER OF PILE                 222RN     2.0E01    2.3E00   PCI/L
25 0240 077 05 8 97     2
132493 ODR04 003        ON- 06 28 74 1455
  SIZE-                OFF- 06 30 74 1120

GRAND JCT COLO CENTER OF PILE                 NO-SAMPLE
25 0240 077 05 8 97     2
133219 ODR05 003        ON- 07 20 74 1405
  SIZE-                OFF- 07 22 74 1150

GRAND JCT COLO CENTER OF PILE                 222RN     1.6E01    2.1E00   PCI/L
25 0240 077 05 8 97     2
133237 ODR05 003        ON- 07 24 74 1405
  SIZE-                OFF- 07 26 74 1145

GRAND JCT COLO CENTER OF PILE                 222RN     9.7E00    1.6E00   PCI/L
25 0240 077 05 8 97     2
133656 ODR06 003        ON- 08 10 74 1010
  SIZE-                OFF- 08 12 74 1115

GRAND JCT COLO CENTER OF PILE                 222RN     1.4E01    1.9E00   PCI/L
25 0240 077 05 8 97     2
134187 ODR07 003        ON- 09 01 74 0910
  SIZE-                OFF- 09 03 74 0910

GRAND JCT COLO CENTER OF PILE                 222RN     1.9E01    2.3E00   PCI/L
25 0240 077 05 8 97     2
134748 ODR08 003        ON- 09 21 74 1018
  SIZE-                OFF- 09 23 74 0953

GRAND JCT COLO CENTER OF PILE                 222RN     1.7E01    2.1E00   PCI/L
25 0240 077 05 8 97     2
135137 ODR09 003        ON- 10 13 74 1025
  SIZE-                OFF- 10 15 74 1030
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GRAND JCT COLORADO 222RN RESULTS

COLORADO                REPORTED  75/07/08
==========================================ANALYSIS---RESULT----2SIGMA---UNITS

GRAND JCT COLO CENTER OF PILE               222RN     1.6E01    2.0E00   PCI/L
25 0240 077 05 8 97     2
135479 ODR10 003         ON- 11 02 74 0900
  SIZE-                 OFF- 11 04 74 1010

GRAND JCT COLO CENTER OF PILE               222RN     8.4E00    1.9E00   PCI/L
25 0240 077 05 8 97     2
141005 ODR11 003         ON- 11 22 74 0930
  SIZE-                 OFF- 11 24 74 0945

GRAND JCT COLO CENTER OF PILE               222RN     1.0E01    2.2E00   PCI/L
25 0240 077 05 8 97     2
141403 ODR12 003         ON- 12 15 74 0920
  SIZE-                 OFF- 12 17 74 1035

GRAND JCT COLO CENTER OF PILE               222RN     2.0E01    2.3E00   PCI/L
25 0240 077 05 8 97     2
141703 ODR13 003         ON- 01 04 75 1005
  SIZE-                 OFF- 01 06 75 0945

GRAND JCT COLO CENTER OF PILE               222RN     3.0E01    2.0E00   PCI/L
25 0240 077 05 8 97     2
142303 ODR14 003         ON- 01 25 75 0945
  SIZE-                 OFF- 01 27 75 1005

GRAND JCT COLO CENTER OF PILE               222RN     1.6E01    2.0E00   PCI/L
25 0240 077 05 8 97     2
142903 ODR15 003         ON- 02 16 75 1005
  SIZE-                 OFF- 02 18 75 1135

GRAND JCT COLO CENTER OF PILE               222RN     8.5E00    1.6E00   PCI/L
25 0240 077 05 8 97     2
143203 ODR16 003         ON- 03 08 75 0950
  SIZE-                 OFF- 03 10 75 1220

GRAND JCT COLO CENTER OF PILE               222RN     9.6E00    1.6E00   PCI/L
25 0240 077 05 8 97     2
144003 ODR17 003         ON- 04 07 75 0945
  SIZE-                 OFF- 04 09 75 1045

GRAND JCT COLO SW CORNER OF PILE            222RN     4.3E01    3.4E00   PCI/L
25 0240 077 05 8 97     2
130645 ODR01 004         ON- 04 29 74 0950
  SIZE-                 OFF- 05 01 74 1020

GRAND JCT COLO SW CORNER OF PILE            222RN     2.9E01    2.6E00   PCI/L
25 0240 077 05 8 97     2
131413 ODR02 004         ON- 05 18 74 1123
  SIZE-                 OFF- 05 20 74 1028
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GRAND JCT COLORADO 222RN RESULTS

COLORADO                 REPORTED  75/07/08
---------------------------------------------ANALYSIS---RESULT----2SIGMA---UNIT

GRAND JCT COLO SW CORNER OF PILE                222RN      4.6E01    3.4E00   PCI/L
25 0240 077 05 8 97      2
131947 ODR03 004        ON- 06 08 74 1200
  SIZE-                OFF- 06 10 74 1125

GRAND JCT COLO SW CORNER OF PILE                222RN      3.9E01    3.2E00   PCI/L
25 0240 077 05 8 97      2
132494 ODR04 004        ON- 06 28 74 1505
  SIZE-                OFF- 06 30 74 1135

GRAND JCT COLO SW CORNER OF PILE                NO-SAMPLE
25 0240 077 05 8 97      2
133220 ODR05 004        ON- 07 20 74 1415
  SIZE-                OFF- 07 22 74 1125

GRAND JCT COLO SW CORNER OF PILE                222RN      2.6E01    2.6E00   PCI/L
25 0240 077 05 8 97      2
133238 ODR05 004        ON- 07 24 74 1415
  SIZE-                OFF- 07 26 74 1155

GRAND JCT COLO SW CORNER OF PILE                222RN      2.7E01    2.5E00   PCI/L
25 0240 077 05 8 97      2
133657 ODR06 004        ON- 08 10 74 1000
  SIZE-                OFF- 08 12 74 1110

GRAND JCT COLO SW CORNER OF PILE                NO-SAMP
25 0240 077 05 8 97      2
134195 ODR07 004        ON- 09 01 74 0920
  SIZE-                OFF- 09 03 74 1015

GRAND JCT COLO SW CORNER OF PILE                222RN      6.6E01    4.2E00   PCI/L
25 0240 077 05 8 97      2
134749 ODR08 004        ON- 09 21 74 1000
  SIZE-                OFF- 09 23 74 0948

GRAND JCT COLO SW CORNER OF PILE                222RN      6.2E01    4.0E00   PCI/L
25 0240 077 05 8 97      2
135138 ODR09 004        ON- 10 13 74 1040
  SIZE-                OFF- 10 15 74 1025

GRAND JCT COLO SW CORNER OF PILE                222RN      3.9E01    3.2E00   PCI/L
25 0240 077 05 8 97      2
135480 ODR10 004        ON- 11 02 74 0945
  SIZE-                OFF- 11 04 74 1020

GRAND JCT COLO SW CORNER OF PILE                222RN      2.8E01    2.7E00   PCI/L
25 0240 077 05 8 97      2
141006 ODR11 004        ON- 11 22 74 0940
  SIZE-                OFF- 11 24 74 0955
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GRAND JCT COLORADO 222RN RESULTS

COLORADO                 REPORTED  75/07/08
---------------------------------------ANALYSIS---RESULT----2SIGMA---UNITS

GRAND JCT COLO SW CORNER OF PILE          222RN       2.9E01     2.8E00    PCI/L
25 0240 077 05 8 97     2
141404 ODR12 004        ON- 12 15 74 0940
  SIZE-                OFF- 12 17 74 1030

GRAND JCT COLO SW CORNER OF PILE          NOSAMPLE
25 0240 077 05 8 97     2
141704 ODR13 004        ON- 01 25 75 1015
  SIZE-                OFF- 01 27 75 0955

GRAND JCT COLO SW CORNER OF PILE          222RN       3.8E01     3.1E00    PCI/L
25 0240 077 05 8 97     2
142304 ODR14 004        ON- 02 03 75 1025
  SIZE-                OFF- 02 05 75 0950

GRAND JCT COLO SW CORNER OF PILE          222RN       4.2E01     3.3E00    PCI/L
25 0240 077 05 8 97     2
142904 ODR15 004        ON- 02 24 75 1055
  SIZE-                OFF- 02 26 75 1005

GRAND JCT COLO SW CORNER OF PILE          222RN       3.4E01     3.0E00    PCI/L
25 0240 077 05 8 97     2
143204 ODR16 004        ON- 03 17 75 1105
  SIZE-                OFF- 03 19 75 1045

GRAND JCT COLO SW CORNER OF PILE          222RN       1.8E01     2.2E00    PCI/L
25 0240 077 05 8 97     2
144004 ODR17 004        ON- 04 07 75 0950
  SIZE-                OFF- 04 09 75 1040

GRAND JCT COLO NW CORNER OF PILE          222RN       1.9E01     2.3E00    PCI/L
25 0240 077 05 8 97     2
130597 ODR01 005        ON- 04 27 74 1040
  SIZE-                OFF- 04 29 74 0955

GRAND JCT COLO NW CORNER OF PILE          222RN       1.7E01     2.1E00    PCI/L
25 0240 077 05 8 97     2
131412 ODR02 005        ON- 05 18 74 1115
  SIZE-                OFF- 05 20 74 1018

GRAND JCT COLO NW CORNER OF PILE          222RN       2.1E01     2.3E00    PCI/L
25 0240 077 05 8 97     2
131948 ODR03 005        ON- 06 08 74 1205
  SIZE-                OFF- 06 10 74 1130

GRAND JCT COLO NW CORNER OF PILE          NO-SAMPLE
25 0240 077 05 8 97     2
133221 ODR05 005        ON- 07 20 74 1420
  SIZE-                OFF- 07 22 74 1130
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GRAND JCT COLORADO 222RN RESULTS

COLORADO                   REPORTED  75/07/08
=========================================---ANALYSIS---RESULT----2SIGMA---UNIT

GRAND JCT COLO NW CORNER OF PILE               222RN        2.3E01     2.4E00   PCI/L
25 0240 077 05 8 97     2
133234 ODR05 005        ON- 07 24 74 1425
  SIZE-                OFF- 07 26 74 1200

GRAND JCT COLO NW CORNER OF PILE               222RN        1.8E01     3.3E-01  PCI/L
25 0240 077 05 8 97     2
133658 ODR06 005        ON- 08 10 74 0945
  SIZE-                OFF- 08 12 74 1045

GRAND JCT COLO NW CORNER OF PILE               222RN        1.9E01     2.3E00   PCI/L
25 0240 077 05 8 97     2
134188 ODR07 005        ON- 09 01 74 0850
  SIZE-                OFF- 09 03 74 0955

GRAND JCT COLO NW CORNER OF PILE               222RN        3.8E01     3.2E00   PCI/L
25 0240 077 05 8 97     2
134750 ODR08 005        ON- 09 21 74 1125
  SIZE-                OFF- 09 23 74 1025

GRAND JCT COLO NW CORNER OF PILE               222RN        3.6E01     3.1E00   PCI/L
25 0240 077 05 8 97     2
135139 ODR09 005        ON- 10 13 74 1055
  SIZE-                OFF- 10 15 74 1040

GRAND JCT COLO NW CORNER OF PILE               222RN        3.9E01     3.6E00   PCI/L
25 0240 077 05 8 97     2
135481 ODR10 005        ON- 11 02 74 0930
  SIZE-                OFF- 11 04 74 1025

GRAND JCT COLO NW CORNER OF PILE               222RN        1.7E01     2.1E00   PCI/L
25 0240 077 05 8 97     2
141007 ODR11 005        ON- 11 22 74 0950
  SIZE-                OFF- 11 24 74 1000

GRAND JCT COLO NW CORNER OF PILE               222RN        2.7E01     2.7E00   PCI/L
25 0240 077 05 8 97     2
141405 ODR12 005        ON- 12 15 74 0935
  SIZE-                OFF- 12 17 74 1030

GRAND JCT COLO NW CORNER OF PILE               222RN        3.5E01     3.1E00   PCI/L
25 0240 077 05 8 97     2
141705 ODR13 005        ON- 01 04 75 1020
  SIZE-                OFF- 01 06 75 0955

GRAND JCT COLO NW CORNER OF PILE               222RN        5.2E01     3.7E00   PCI/L
25 0240 077 05 8 97     2
142305 ODR14 005        ON- 01 25 75 1005
  SIZE-                OFF- 01 27 75 1020
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GRAND JCT COLORADO 222RN RESULTS

COLORADO                 REPORTED  75/07/08
-----------------------------------------ANALYSIS---RESULT----2SIGMA---UNITS

GRAND JCT COLO NW CORNER OF PILE         222RN      2.7E01    2.6E00   PCI/L
25 0240 077 05 8 97    2
142905 ODR15 005        ON- 02 16 75 1020
  SIZE-                OFF- 02 18 75 1150

GRAND JCT COLO NW CORNER OF PILE         222RN      8.2E00    1.5E00   PCI/L
25 0240 077 05 8 97    2
143205 ODR16 005        ON- 03 08 75 1005
  SIZE-                OFF- 03 10 75 1235

GRAND JCT COLO NW CORNER OF PILE         222RN      2.5E01    2.6E00   PCI/L
25 0240 077 05 8 97    2
146005 ODR17 005        ON- 03 29 75 1110
  SIZE-                OFF- 03 31 75 1100

GRAND JCT COLO                           222RN      5.9E00    1.9E-01  PCI/L
25 0240 077 05 8 97    2
130598 ODR01 006        ON- 04 27 74 1105
  SIZE-                OFF- 04 29 74 1007

GRAND JCT COLO                           222RN      3.3E00    1.4E-01  PCI/L
25 0240 077 05 8 97    2
131414 ODR02 006        ON- 05 18 74 1132
  SIZE-                OFF- 05 20 74 1039

GRAND JCT COLO                           222RN      5.0E00    1.7E-01  PCI/L
25 0240 077 05 8 97    2
131949 ODR03 006        ON- 06 08 74 1130
  SIZE-                OFF- 06 10 74 1205

GRAND JCT COLO                           222RN      9.9E00    1.6E00   PCI/L
25 0240 077 05 8 97    2
132495 ODR04 006        ON- 06 28 74 1545
  SIZE-                OFF- 06 30 74 1150

GRAND JCT COLO                           222RN      2.4E00    1.2E-01  PCI/L
25 0240 077 05 8 97    2
133222 ODR05 006        ON- 07 20 74 1430
  SIZE-                OFF- 07 22 74 1340

GRAND JCT COLO                           222RN      3.7E00    1.5E-01  PCI/L
25 0240 077 05 8 97    2
133665 ODR06 006        ON- 08 12 74 1040
  SIZE-                OFF- 08 14 74 0835

GRAND JCT COLO                           NO-SAMP
25 0240 077 05 8 97    2
134196 ODR07 006        ON- 09 01 74 0840
  SIZE-                OFF- 09 03 74 1015
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GRAND JCT COLORADO 222RN RESULTS

COLORADO                REPORTED  75/07/08
=======================================ANALYSIS---RESULT----2SIGMA---UNITS

GRAND JCT COLO                             222RN      3.8E00    1.5E-01  PCI/L
25 0240 077 05 8 97       2
134340 ODR07 006        ON- 09 09 74 1001
  SIZE-                OFF- 09 11 74 0906

GRAND JCT COLO                             222RN      1.3E01    2.8E-01  PCI/L
25 0240 077 05 8 97       2
134751 ODR08 006        ON- 09 21 74 0944
  SIZE-                OFF- 09 23 74 0935

GRAND JCT COLO                             222RN      1.4E01    1.9E00   PCI/L
25 0240 077 05 8 97       2
135140 ODR09 006        ON- 10 13 74 0950
  SIZE-                OFF- 10 15 74 1100

GRAND JCT COLO                             222RN      3.7E00    1.5E-01  PCI/L
25 0240 077 05 8 97       2
135482 ODR10 006        ON- 11 02 74 0825
  SIZE-                OFF- 11 04 74 1040

GRAND JCT COLO                             222RN      4.8E00    1.7E-01  PCI/L
25 0240 077 05 8 97       2
141008 ODR11 006        ON- 11 22 74 1005
  SIZE-                OFF- 11 24 74 1010

GRAND JCT COLO                             222RN      7.0E00    1.4E00   PCI/L
25 0240 077 05 8 97       2
141406 ODR12 006        ON- 12 15 74 0950
  SIZE-                OFF- 12 17 74 1045

GRAND JCT COLO                             222RN      6.3E00    2.0E-01  PCI/L
25 0240 077 05 8 97       2
141706 ODR13 006        ON- 01 04 75 0940
  SIZE-                OFF- 01 06 75 1005

GRAND JCT COLO                             222RN      1.4E01    2.9E-01  PCI/L
25 0240 077 05 8 97       2
142306 ODR14 006        ON- 01 25 75 0925
  SIZE-                OFF- 01 27 75 1030

GRAND JCT COLO                             222RN      5.6E00    1.8E-01  PCI/L
25 0240 077 05 8 97       2
142906 ODR15 006        ON- 02 16 75 0950
  SIZE-                OFF- 02 18 75 1200

GRAND JCT COLO                             222RN      7.1E-01   6.7E-02  PCI/L
25 0240 077 05 8 97       2
143206 ODR16 006        ON- 03 08 75 0930
  SIZE-                OFF- 03 10 75 1250
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GRAND JCT COLORADO 222RN RESULTS

COLORADO                  REPORTED  75/07/08
----------------------------------------ANALYSIS---RESULT----2SIGMA---UNITS

GRAND JCT COLO                              222RN      8.1E00     2.4E-01  PCI/L
25 0240 077 05 8 97     2
144006 ODR17 006         ON- 03 29 75 1025
  SIZE-                 OFF- 03 31 75 1030

GRAND JCT COLO                              222RN      1.0E00     8.1E-02  PCI/L
25 0240 077 05 8 97     2
130599 ODR01 007         ON- 04 27 74 1203
  SIZE-                 OFF- 04 29 74 1028

GRAND JCT COLO                              222RN      6.5E-01    6.4E-02  PCI/L
25 0240 077 05 8 97     2
131415 ODR02 007         ON- 05 18 74 1144
  SIZE-                 OFF- 05 20 74 1056

GRAND JCT COLO                              222RN      7.5E-01    6.8E-02  PCI/L
25 0240 077 05 8 97     2
131950 ODR03 007         ON- 06 08 74 1145
  SIZE-                 OFF- 06 10 74 1300

GRAND JCT COLO                              222RN      1.6E00     9.8E-02  PCI/L
25 0240 077 05 8 97     2
132496 ODR04 007         ON- 06 28 74 1555
  SIZE-                 OFF- 06 30 74 1405

GRAND JCT COLO                              NO-SAMPLE
25 0240 077 05 8 97     2
133223 ODR05 007         ON- 07 20 74 1440
  SIZE-                 OFF- 07 22 74 1050

GRAND JCT COLO                              222RN      5.6E-01    5.8E-02  PCI/L
25 0240 077 05 8 97     2
133240 ODR05 007         ON- 07 24 74 1130
  SIZE-                 OFF- 07 26 74 1225

GRAND JCT COLO                              222RN      2.8E-01    4.1E-02  PCI/L
25 0240 077 05 8 97     2
133659 ODR06 007         ON- 08 10 74 1105
  SIZE-                 OFF- 08 12 74 1015

GRAND JCT COLO                              222RN      9.6E-01    7.6E-02  PCI/L
25 0240 077 05 8 97     2
134189 ODR07 007         ON- 09 01 74 0955
  SIZE-                 OFF- 09 03 74 0940

GRAND JCT COLO                              222RN      2.9E00     1.4E-01  PCI/L
25 0240 077 05 8 97     2
134752 ODR08 007         ON- 09 21 74 0908
  SIZE-                 OFF- 09 23 74 0845
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GRAND JCT COLORADO 222RN RESULTS

COLORADO                REPORTED  75/07/08
---------------------------------------------ANALYSIS---RESULT----2SIGMA---UNITS

GRAND JCT COLO                                  222RN       2.4E00    1.2E-01  PCI/L
25 0240 077 05 8 97     2
135141 ODR09 007          ON- 10 13 74 0935
  SIZE-                  OFF- 10 15 74 0940

GRAND JCT COLO                                  222RN       7.5E-01   6.9E-02  PCI/L
25 0240 077 05 8 97     2
135483 ODR10 007          ON- 11 02 74 1005
  SIZE-                  OFF- 11 04 74 0900

GRAND JCT COLO                                  222RN       1.6E00    1.6E-01  PCI/L
25 0240 077 05 8 97     2
141407 ODR12 007          ON- 12 15 74 1000
  SIZE-                  OFF- 12 17 74 0945

GRAND JCT COLO                                  222RN       1.3E00    8.9E-02  PCI/L
25 0240 077 05 8 97     2
141707 ODR13 007          ON- 01 04 75 0920
  SIZE-                  OFF- 01 06 75 0905

GRAND JCT COLO                                  222RN       2.9E00    1.5E-01  PCI/L
25 0240 077 05 8 97     2
142307 ODR14 007          ON- 01 25 75 0900
  SIZE-                  OFF- 01 27 75 0915

GRAND JCT COLO                                  222RN       1.1E00    8.5E-02  PCI/L
25 0240 077 05 8 97     2
142907 ODR15 007          ON- 02 16 75 0930
  SIZE-                  OFF- 02 18 75 0925

GRAND JCT COLO                                  222RN       4.8E-01   6.1E-02  PCI/L
25 0240 077 05 8 97     2
143207 ODR16 007          ON- 03 08 75 0905
  SIZE-                  OFF- 03 10 75 1000

GRAND JCT COLO                                  222RN       1.6E00    1.0E-01  PCI/L
25 0240 077 05 8 97     2
144007 ODR17 007          ON- 03 29 75 1005
  SIZE-                  OFF- 03 31 75 0955

GRAND JCT COLO                                  222RN       1.2E00    8.7E-02  PCI/L
25 0240 077 05 8 97     2
130600 ODR01 008          ON- 04 27 74 1234
  SIZE-                  OFF- 04 29 74 1050

GRAND JCT COLO                                  222RN       8.5E-01   7.2E-02  PCI/L
25 0240 077 05 8 97     2
131416 ODR02 008          ON- 05 18 74 1156
  SIZE-                  OFF- 05 20 74 1110
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GRAND JCT COLORADO 222RN RESULTS

COLORADO                  REPORTED  75/07/08
---------------------------------------------ANALYSIS---RESULT----2SIGMA---UNITS

GRAND JCT COLO                              222RN       6.6E-01   6.3E-02  PCI/L
25 0240 077 05 8 97     2
131951 ODR03 008        ON- 06 08 74 1230
  SIZE-                OFF- 06 10 74 1320

GRAND JCT COLO                              222RN       1.1E00    8.3E-02  PCI/L
25 0240 077 05 8 97     2
132497 ODR04 008        ON- 06 28 74 1610
  SIZE-                OFF- 06 30 74 1355

GRAND JCT COLO                              222RN       3.9E-01   4.9E-02  PCI/L
25 0240 077 05 8 97     2
133224 ODR05 008        ON- 07 20 74 1445
  SIZE-                OFF- 07 22 74 1110

GRAND JCT COLO                              222RN       5.7E-01   5.9E-02  PCI/L
25 0240 077 05 8 97     2
133660 ODR06 008        ON- 08 10 74 1050
  SIZE-                OFF- 08 12 74 1005

GRAND JCT COLO                              222RN       9.5E-01   1.0E-01  PCI/L
25 0240 077 05 8 97     2
134191 ODR07 008        ON- 09 01 74 1005
  SIZE-                OFF- 09 03 74 0930

GRAND JCT COLO                              222RN       8.9E-01   7.3E-02  PCI/L
25 0240 077 05 8 97     2
134945 ODR08 008        ON- 09 30 74 0945
  SIZE-                OFF- 10 02 74 0955

GRAND JCT COLO                              222RN       1.9E00    1.1E-01  PCI/L
25 0240 077 05 8 97     2
135142 ODR09 008        ON- 10 13 74 0935
  SIZE-                OFF- 10 15 74 1005

GRAND JCT COLO                              222RN       1.9E00    1.1E-01  PCI/L
25 0240 077 05 8 97     2
135484 ODR10 008        ON- 11 02 74 1020
  SIZE-                OFF- 11 04 74 0925

GRAND JCT COLO                              222RN       1.1E00    8.3E-02  PCI/L
25 0240 077 05 8 97     2
141010 ODR11 008        ON- 11 22 74 1110
  SIZE-                OFF- 11 24 74 0910

GRAND JCT COLO                              222RN       2.2E00    1.2E-01  PCI/L
25 0240 077 05 8 97     2
141408 ODR12 008        ON- 12 15 74 1010
  SIZE-                OFF- 12 17 74 0955
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GRAND JCT COLORADO 222RN RESULTS

COLORADO                     REPORTED  75/07/08
-----------------------------------------------ANALYSIS---RESULT----2SIGMA---UNITS

GRAND JCT COLO                                  222RN      4.1E00    1.6E-01  PCI/L
25 0240 077 05 8 97      2
141708 ODR13 008         ON- 01 04 75 0930
  SIZE-                 OFF- 01 06 75 0920

GRAND JCT COLO                                  222RN      3.8E00    1.7E-01  PCI/L
25 0240 077 05 8 97      2
142308 ODR14 008         ON- 01 25 75 0910
  SIZE-                 OFF- 01 27 75 0940

GRAND JCT COLO                                  222RN      2.6E00    1.3E-01  PCI/L
25 0240 077 05 8 97      2
142908 ODR15 008         ON- 02 16 75 0935
  SIZE-                 OFF- 02 18 75 0945

GRAND JCT COLO                                  222RN      6.3E-01   7.5E-02  PCI/L
25 0240 077 05 8 97      2
143208 ODR16 008         ON- 03 08 75 0915
  SIZE-                 OFF- 03 10 75 1015

GRAND JCT COLO                                  222RN      1.7E00    1.1E-01  PCI/L
25 0240 077 05 8 97      2
144008 ODR17 008         ON- 03 29 75 1015
  SIZE-                 OFF- 03 31 75 1010

GRAND JCT COLO                                  222RN      2.1E-01   3.7E-02  PCI/L
25 0240 077 05 8 97      2
130601 ODR01 009         ON- 04 27 74 1500
  SIZE-                 OFF- 04 29 74 1208

GRAND JCT COLO                                  NO-SAMPLE
25 0240 077 05 8 97      2
131417 ODR02 009         ON- 05 18 74 1243
  SIZE-                 OFF- 05 20 74 1137

GRAND JCT COLO                                  222RN      5.6E-01   5.9E-02  PCI/L
25 0240 077 05 8 97      2
131952 ODR03 009         ON- 06 08 74 1050
  SIZE-                 OFF- 06 10 74 1040

GRAND JCT COLO                                  222RN      4.9E-01   5.5E-02  PCI/L
25 0240 077 05 8 97      2
132498 ODR04 009         ON- 06 28 74 1045
  SIZE-                 OFF- 06 30 74 1230

GRAND JCT COLO                                  222RN      3.9E-01   4.9E-02  PCI/L
25 0240 077 05 8 97      2
133225 ODR05 009         ON- 07 20 74 1505
  SIZE-                 OFF- 07 22 74 0940
```

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GRAND JCT COLORADO 222RN RESULTS

COLORADO                  REPORTED  75/07/08
----------------------------------------ANALYSIS---RESULT----2SIGMA---UNITS

GRAND JCT COLO                                222RN         5.2E-01   5.8E-02  PCI/L
25 0240 077 05 8 97       2
133661 ODR06 009          ON- 08 10 74 1130
  SIZE-                  OFF- 08 12 74 0805

GRAND JCT COLO                                NO-SAMP
25 0240 077 05 8 97       2
134192 ODR07 009          ON- 09 01 74 0745
  SIZE-                  OFF- 09 03 74 0810

GRAND JCT COLO                                222RN         4.9E-01   5.5E-02  PCI/L
25 0240 077 05 8 97       2
134341 ODR07 009          ON- 09 09 74 1141
  SIZE-                  OFF- 09 11 74 1025

GRAND JCT COLO                                222RN         1.4E00    9.2E-02  PCI/L
25 0240 077 05 8 97       2
134753 ODR08 009          ON- 09 21 74 1256
  SIZE-                  OFF- 09 23 74 1225

GRAND JCT COLO                                222RN         5.0E-01   5.4E-02  PCI/L
25 0240 077 05 8 97       2
135149 ODR09 009          ON- 10 21 74 1140
  SIZE-                  OFF- 10 23 74 1145

GRAND JCT COLO                                222RN         5.8E-01   6.0E-02  PCI/L
25 0240 077 05 8 97       2
135485 ODR10 009          ON- 11 02 74 1135
  SIZE-                  OFF- 11 04 74 1225

GRAND JCT COLO                                222RN         6.8E-01   6.5E-02  PCI/L
25 0240 077 05 8 97       2
141011 ODR11 009          ON- 11 22 74 1210
  SIZE-                  OFF- 11 24 74 1100

GRAND JCT COLO                                222RN         7.8E-01   6.9E-02  PCI/L
25 0240 077 05 8 97       2
141409 ODR12 009          ON- 12 15 74 1115
  SIZE-                  OFF- 12 17 74 1220

GRAND JCT COLO                                222RN         7.7E-01   6.9E-02  PCI/L
25 0240 077 05 8 97       2
141709 ODR13 009          ON- 01 04 75 1135
  SIZE-                  OFF- 01 06 75 1135

GRAND JCT COLO                                222RN         1.4E00    9.0E-02  PCI/L
25 0240 077 05 8 97       2
142309 ODR14 009          ON- 01 25 75 1105
  SIZE-                  OFF- 01 27 75 1200
```

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GRAND JCT COLORADO 222RN RESULTS

 COLORADO                 REPORTED  75/07/08
---------------------------------------ANALYSIS---RESULT----2SIGMA---UNITS

GRAND JCT COLO                                222RN      2.8E-01   4.3E-02  PCI/L
25 0240 077 05 8 97     2
142909 ODR15 009        ON- 02 16 75 1130
  SIZE-                OFF- 02 18 75 1050

GRAND JCT COLO                                222RN      4.3E-01   5.7E-02  PCI/L
25 0240 077 05 8 97     2
143209 ODR16 009        ON- 03 08 75 1110
  SIZE-                OFF- 03 10 75 1145

GRAND JCT COLO                                222RN      5.3E-01   5.8E-02  PCI/L
25 0240 077 05 8 97     2
144009 ODR17 009        ON- 03 29 75 1240
  SIZE-                OFF- 03 31 75 1220

GRAND JCT COLO                                222RN      1.3E00    9.0E-02  PCI/L
25 0240 077 05 8 97     2
130602 ODR01 010        ON- 04 27 74 1430
  SIZE-                OFF- 04 29 74 0900

GRAND JCT COLO                                222RN      2.4E00    1.2E-01  PCI/L
25 0240 077 05 8 97     2
131953 ODR03 010        ON- 06 08 74 1110
  SIZE-                OFF- 06 10 74 1100

GRAND JCT COLO                                222RN      3.4E00    1.7E-01  PCI/L
25 0240 077 05 8 97     2
132584 ODR04 010        ON- 06 28 74 1105
  SIZE-                OFF- 06 30 74 1305

GRAND JCT COLO                                NO-SAMPLE
25 0240 077 05 8 97     2
133226 ODR05 010        ON- 07 20 74 1520
  SIZE-                OFF- 07 22 74 1010

GRAND JCT COLO                                222RN      1.2E00    8.2E-02  PCI/L
25 0240 077 05 8 97     2
133598 ODR06 010        ON- 08 06 74 1355
  SIZE-                OFF- 08 08 74 1350

GRAND JCT COLO                                222RN      8.0E-01   7.1E-02  PCI/L
25 0240 077 05 8 97     2
133662 ODR06 010        ON- 08 10 74 0850
  SIZE-                OFF- 08 12 74 0745

GRAND JCT COLO                                222RN      1.4E00    9.4E-02  PCI/L
25 0240 077 05 8 97     2
134190 ODR07 010        ON- 09 01 74 0815
  SIZE-                OFF- 09 03 74 0750
```

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GRAND JCT COLORADO 222RN RESULTS

COLORADO                REPORTED  75/07/08
--------------------------------------ANALYSIS---RESULT----2SIGMA---UNITS

GRAND JCT COLO                             NO-SAMPLE
25 0240 077 05 8 97     2
134754 ODR08 010       ON- 09 21 74 1200
  SIZE-               OFF- 09 23 74 1048

GRAND JCT COLO                             222RN      5.3E00    1.8E-01  PCI/L
25 0240 077 05 8 97     2
134946 ODR08 010       ON- 09 30 74 1000
  SIZE-               OFF- 10 02 74 1005

GRAND JCT COLO                             NO-SAMPLE
25 0240 077 05 8 97     2
135150 ODR09 010       ON- 10 21 74 1030
  SIZE-               OFF- 10 23 74 1055

GRAND JCT COLO                             222RN      9.7E-01   7.8E-02  PCI/L
25 0240 077 05 8 97     2
135486 ODR10 010       ON- 11 02 74 1055
  SIZE-               OFF- 11 04 74 1155

GRAND JCT COLO                             222RN      1.7E00    1.0E-01  PCI/L
25 0240 077 05 8 97     2
141012 ODR11 010       ON- 11 22 74 1015
  SIZE-               OFF- 11 24 74 1215

GRAND JCT COLO                             222RN      2.2E00    7.9E-01  PCI/L
25 0240 077 05 8 97     2
141410 ODR12 010       ON- 12 15 74 1040
  SIZE-               OFF- 12 17 74 1115

GRAND JCT COLO                             222RN      2.0E00    1.1E-01  PCI/L
25 0240 077 05 8 97     2
141710 ODR13 010       ON- 01 04 75 1100
  SIZE-               OFF- 01 06 75 1035

GRAND JCT COLO                             222RN      2.8E00    1.4E-01  PCI/L
25 0240 077 05 8 97     2
142310 ODR14 010       ON- 01 25 75 1035
  SIZE-               OFF- 01 27 75 1055

GRAND JCT COLO                             222RN      3.6E00    1.5E-01  PCI/L
25 0240 077 05 8 97     2
142910 ODR15 010       ON- 02 24 75 1035
  SIZE-               OFF- 02 26 75 1015

GRAND JCT COLO                             222RN      4.3E-01   6.0E-02  PCI/L
25 0240 077 05 8 97     2
143210 ODR16 010       ON- 03 08 75 1025
  SIZE-               OFF- 03 10 75 1040
```

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GRAND JCT COLORADO 222RN RESULTS

COLORADO                  REPORTED  75/07/08
--------------------------------------------------ANALYSIS---RESULT----2SIGMA---UNITS

GRAND JCT COLO                                    222RN      6.8E-01   7.0E-02  PCI/L
25 0240 077 05 8 97     2
144010 ODR17 010          ON- 03 31 75 1115
  SIZE-                  OFF- 04 02 75 1010

GRAND JCT COLO                                    222RN      4.7E00    1.7E-01  PCI/L
25 0240 077 05 8 97     2
130603 ODR01 011          ON- 04 27 74 1415
  SIZE-                  OFF- 04 29 74 1122

GRAND JCT COLO                                    222RN      3.1E00    1.4E-01  PCI/L
25 0240 077 05 8 97     2
131427 ODR02 011          ON- 05 18 74 1210
  SIZE-                  OFF- 05 20 74 1124

GRAND JCT COLO                                    222RN      7.1E00    1.3E00   PCI/L
25 0240 077 05 8 97     2
131954 ODR03 011          ON- 06 08 74 1125
  SIZE-                  OFF- 06 10 74 1240

GRAND JCT COLO                                    222RN      9.3E00    1.6E00   PCI/L
25 0240 077 05 8 97     2
132499 ODR04 011          ON- 06 28 74 1120
  SIZE-                  OFF- 06 30 74 1255

GRAND JCT COLO                                    NO-SAMPLE
25 0240 077 05 8 97     2
133227 ODR05 011          ON- 07 20 74 1525
  SIZE-                  OFF- 07 22 74 1025

GRAND JCT COLO                                    222RN      3.6E00    1.5E-01  PCI/L
25 0240 077 05 8 97     2
133232 ODR05 011          ON- 07 24 74 1115
  SIZE-                  OFF- 07 26 74 1240

GRAND JCT COLO                                    222RN      3.6E00    1.5E-01  PCI/L
25 0240 077 05 8 97     2
133663 ODR06 011          ON- 08 10 74 0910
  SIZE-                  OFF- 08 12 74 0755

GRAND JCT COLO                                    222RN      3.3E00    1.4E-01  PCI/L
25 0240 077 05 8 97     2
134194 ODR07 011          ON- 09 01 74 0825
  SIZE-                  OFF- 09 03 74 0800

GRAND JCT COLO                                    222RN      1.7E01    2.1E00   PCI/L
25 0240 077 05 8 97     2
134755 ODR08 011          ON- 09 21 74 1219
  SIZE-                  OFF- 09 23 74 1100
```

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GRAND JCT COLORADO 222RN RESULTS

COLORADO                    REPORTED  75/07/08
----------------------------------------------ANALYSIS---RESULT----2SIGMA---UNITS

GRAND JCT COLO                                  222RN     1.1E01     1.7E00   PCI/L
25 0240 077 05 8 97     2
135143 ODR09 011         ON- 10 13 74 0825
  SIZE-                 OFF- 10 15 74 0855

GRAND JCT COLO                                  222RN     1.1E01     2.5E-01  PCI/L
25 0240 077 05 8 97     2
135488 ODR10 011         ON- 11 04 74 1115
  SIZE-                 OFF- 11 06 74 0945

GRAND JCT COLO                                  222RN     5.6E00     1.9E-01  PCI/L
25 0240 077 05 8 97     2
141013 ODR11 011         ON- 11 22 74 1130
  SIZE-                 OFF- 11 24 74 1035

GRAND JCT COLO                                  222RN     7.1E00     1.4E00   PCI/L
25 0240 077 05 8 97     2
141411 ODR12 011         ON- 12 15 74 1025
  SIZE-                 OFF- 12 17 74 1105

GRAND JCT COLO                                  222RN     6.7E00     2.0E-01  PCI/L
25 0240 077 05 8 97     2
141711 ODR13 011         ON- 01 04 75 1050
  SIZE-                 OFF- 01 06 75 1025

GRAND-JCT COLO                                  222RN     1.3E01     2.8E-01  PCI/L
25 0240 077 05 8 97     2
142311 ODR14 011         ON- 01 25 75 1025
  SIZE-                 OFF- 01 27 75 1045

GRAND JCT COLO                                  222RN     5.8E00     1.9E-01  PCI/L
25 0240 077 05 8 97     2
142911 ODR15 011         ON- 02 16 75 1045
  SIZE-                 OFF- 02 18 75 0955

GRAND JCT COLO                                  222RN     1.2E00     8.0E-02  PCI/L
25 0240 077 05 8 97     2
143211 ODR16 011         ON- 03 10 75 1035
  SIZE-                 OFF- 03 12 75 1010

GRAND JCT COLO                                  222RN     8.9E00     2.6E-01  PCI/L
25 0240 077 05 8 97     2
144011 ODR17 011         ON- 03 29 75 1135
  SIZE-                 OFF- 03 31 75 1120

GRAND JCT COLO                                  222RN     6.2E-01    6.3E-02  PCI/L
25 0240 077 05 8 97     2
130604 ODR01 012         ON- 04 27 74 1346
  SIZE-                 OFF- 04 29 74 1333
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GRAND JCT COLORADO 222RN RESULTS

COLORADO                 REPORTED  75/07/08
---------------------------------------------ANALYSIS---RESULT----2SIGMA---UNITS

GRAND JCT COLO                               222RN       4.6E-01   5.3E-02  PCI/L
25 0240 077 05 8 97      2
131428 ODR02 012         ON- 05 18 74 1330
  SIZE-                 OFF- 05 20 74 1345

GRAND JCT COLO                               222RN       8.1E-01   7.1E-02  PCI/L
25 0240 077 05 8 97      2
131955 ODR03 012         ON- 06 08 74 1325
  SIZE-                 OFF- 06 10 74 1345

GRAND JCT COLO                               222RN       7.7E-01   6.9E-02  PCI/L
25 0240 077 05 8 97      2
132500 ODR04 012         ON- 06 28 74 1200
  SIZE-                 OFF- 06 30 74 1415

GRAND JCT COLO                               222RN       6.8E-01   6.5E-02  PCI/L
25 0240 077 05 8 97      2
133228 ODR05 012         ON- 07 20 74 1555
  SIZE-                 OFF- 07 22 74 1400

GRAND JCT COLO                               222RN       4.7E-01   5.6E-02  PCI/L
25 0240 077 05 8 97      2
133664 ODR06 012         ON- 08 10 74 0835
  SIZE-                 OFF- 08 12 74 0730

GRAND JCT COLO                               222RN       5.1E-01   6.2E-02  PCI/L
25 0240 077 05 8 97      2
134193 ODR07 012         ON- 09 01 74 0800
  SIZE-                 OFF- 09 03 74 0740

GRAND JCT COLO                               222RN       1.6E00    9.9E-02  PCI/L
25 0240 077 05 8 97      2
134756 ODR08 012         ON- 09 21 74 1241
  SIZE-                 OFF- 09 23 74 1201

GRAND JCT COLO                               222RN       9.0E-01   6.6E-02  PCI/L
25 0240 077 05 8 97      2
135151 ODR09 012         ON- 10 21 74 1110
  SIZE-                 OFF- 10 23 74 1125

GRAND JCT COLO                               222RN       1.5E00    9.5E-02  PCI/L
25 0240 077 05 8 97      2
135487 ODR10 012         ON- 11 02 74 1110
  SIZE-                 OFF- 11 04 74 1150

GRAND JCT COLO                               222RN       8.2E-01   7.2E-02  PCI/L
25 0240 077 05 8 97      2
141014 ODR11 012         ON- 11 22 74 1145
  SIZE-                 OFF- 11 24 74 1130
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GRAND JCT COLORADO 222RN RESULTS

COLORADO                 REPORTED  75/07/08
---------------------------------------------ANALYSIS---RESULT----2SIGMA---UNITS

                                             222RN      9.1E-01   7.5E-02  PCI/L
GRAND JCT COLO
25 0240 077 05 8 97     2
141412 ODR12 012          ON- 12 15 74 1055
  SIZE-                  OFF- 12 17 74 1150

                                             222RN      1.6E00    9.9E-02  PCI/L
GRAND JCT COLO
25 0240 077 05 8 97     2
141712 ODR13 012          ON- 01 04 75 1115
  SIZE-                  OFF- 01 06 75 1105

                                             222RN      2.0E00    1.2E-01  PCI/L
GRAND JCT COLO
25 0240 077 05 8 97     2
142312 ODR14 012          ON- 01 25 75 1045
  SIZE-                  OFF- 01 27 75 1130

                                             222RN      1.1E00    8.3E-02  PCI/L
GRAND JCT COLO
25 0240 077 05 8 97     2
142912 ODR15 012          ON- 02 16 75 1110
  SIZE-                  OFF- 02 18 75 1015

                                             222RN      4.4E-01   5.8E-02  PCI/L
GRAND JCT COLO
25 0240 077 05 8 97     2
143212 ODR16 012          ON- 03 08 75 1050
  SIZE-                  OFF- 03 10 75 1115

                                             222RN      1.0E00    8.0E-02  PCI/L
GRAND JCT COLO
25 0240 077 05 8 97     2
144012 ODR17 012          ON- 03 29 75 1200
  SIZE-                  OFF- 03 31 75 1155

                                             222RN      4.1E-01   5.0E-02  PCI/L
GRAND JCT COLO
25 0240 077 05 8 97     2
130646 ODR01 013          ON- 04 29 74 1200
  SIZE-                  OFF- 05 01 74 1100

                                             222RN      8.9E-01   7.2E-02  PCI/L
GRAND JCT COLO
25 0240 077 05 8 97     2
131581 ODR02 013          ON- 05 21 74 1340
  SIZE-                  OFF- 05 23 74 1150

                                             222RN      1.1E00    8.2E-02  PCI/L
GRAND JCT COLO
25 0240 077 05 8 97     2
131956 ODR03 013          ON- 06 10 74 1550
  SIZE-                  OFF- 06 12 74 1110

                                             222RN      3.2E-01   5.3E-02  PCI/L
GRAND JCT COLO
25 0240 077 05 8 97     2
132586 ODR04 013          ON- 06 30 74 1210
  SIZE-                  OFF- 07 02 74 1105
```

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GRAND JCT COLORADO 222RN RESULTS

COLORADO               REPORTED  75/07/08
-------------------------------------------ANALYSIS---RESULT----2SIGMA---UNITS

GRAND JCT COLO                             222RN      2.4E-01   3.9E-02  PCI/L
25 0240 077 05 8 97    2
133230 ODR05 013      ON- 07 22 74 0950
  SIZE-              OFF- 07 24 74 1050

GRAND JCT COLO                             NO-SAMPLE
25 0240 077 05 8 97    2
134197 ODR07 013      ON- 09 03 74 1110
  SIZE-              OFF- 09 05 74 1100

GRAND JCT COLO                             222RN      4.6E-01   5.4E-02  PCI/L
25 0240 077 05 8 97    2
134342 ODR07 013      ON- 09 09 74 1205
  SIZE-              OFF- 09 11 74 1038

GRAND JCT COLO-                            222RN      8.0E-01   6.9E-02  PCI/L
25 0240 077 05 8 97    2
134757 ODR08 013      ON- 09 23 74 1425
  SIZE-              OFF- 09 25 74 1130

GRAND JCT COLO                             222RN      1.5E00    9.5E-02  PCI/L
25 0240 077 05 8 97    2
135144 ODR09 013      ON- 10 15 74 1300
  SIZE-              OFF- 10 17 74 1100

GRAND JCT COLO                             222RN      9.4E-01   7.4E-02  PCI/L
25 0240 077 05 8 97    2
135489 ODR10 013      ON- 11 04 74 1220
  SIZE-              OFF- 11 06 74 1020

GRAND JCT COLO                             222RN      1.7E00    1.0E-01  PCI/L
25 0240 077 05 8 97    2
141015 ODR11 013      ON- 11 24 74 1200
  SIZE-              OFF- 11 26 74 1105

GRAND JCT COLO                             222RN      9.3E-01   7.5E-02  PCI/L
25 0240 077 05 8 97    2
141413 ODR12 013      ON- 12 31 74 0955
  SIZE-              OFF- 01 02 75 0940

GRAND JCT COLO                             SAMPLE-LOST
25 0240 077 05 8 97    2
141713 ODR13 013      ON- 01 07 75 1035
  SIZE-              OFF- 01 09 75 1010

GRAND JCT COLO                             222RN      1.5E00    9.5E-02  PCI/L
25 0240 077 05 8 97    2
141920 ODR13 013      ON- 01 14 75 1010
  SIZE-              OFF- 01 16 75 1005
```

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GRAND JCT COLORADO 222RN RESULTS

COLORADO               REPORTED  75/07/08
-------------------------------------------ANALYSIS---RESULT----2SIGMA---UNITS

GRAND JCT COLO                             222RN      3.7E-01   4.7E-02  PCI/L
25 0240 077 05 8 97     2
142313 ODR14 013      ON- 01 27 75 1155
  SIZE-              OFF- 01 29 75 1025

GRAND JCT COLO                             222RN      4.6E-01   5.4E-02  PCI/L
25 0240 077 05 8 97     2
142913 ODR15 013      ON- 02 18 75 1115
  SIZE-              OFF- 02 20 75 1115

GRAND JCT COLO                             222RN      4.1E-01   5.6E-02  PCI/L
25 0240 077 05 8 97     2
143213 ODR16 013      ON- 03 10 75 1310
  SIZE-              OFF- 03 12 75 1050

GRAND JCT COLO                             222RN      2.4E-01   3.8E-02  PCI/L
25 0240 077 05 8 97     2
144013 ODR17 013      ON- 03 31 75 1240
  SIZE-              OFF- 04 02 75 1115

GRAND JCT COLO                             222RN      9.8E-01   8.0E-02  PCI/L
25 0240 077 05 8 97     2
130647 ODR01 014      ON- 04 29 74 1041
  SIZE-              OFF- 05 01 74 0958

GRAND JCT COLO                             NO-SAMPLE       .
25 0240 077 05 8 97     2
131582 ODR02 014      ON- 05 21 74 1410
  SIZE-              OFF- 05 23 74 1420

GRAND JCT COLO                             222RN      8.5E-01   7.1E-02  PCI/L
25 0240 077 05 8 97     2
131957 ODR03 014      ON- 06 10 74 1315
  SIZE-              OFF- 06 12 74 0955

GRAND JCT COLO                             222RN      6.3E-01   7.4E-02  PCI/L
25 0240 077 05 8 97     2
132587 ODR04 014      ON- 06 30 74 1350
  SIZE-              OFF- 07 02 74 1025

GRAND JCT COLO                             222RN      3.8E-01   4.9E-02  PCI/L
25 0240 077 05 8 97     2
133242 ODR05 014      ON- 07 24 74 1140
  SIZE-              OFF- 07 26 74 1215

GRAND JCT COLO                             222RN      2.1E00    1.1E-01  PCI/L
25 0240 077 05 8 97     2
134078 ODR06 014      ON- 08 19 74 0915
  SIZE-              OFF- 08 21 74 0855
```

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GRAND JCT COLORADO 222RN RESULTS

COLORADO                  REPORTED  75/07/08
---------------------------------------------ANALYSIS---RESULT----2SIGMA---UNI

GRAND JCT COLO                                  222RN       6.1E-01   6.1E-02  PCI/
25 0240 077 05 8 97      2
134198 ODR07 014         ON- 09 03 74 0925
  SIZE-                 OFF- 09 05 74 0910

GRAND JCT COLO                                  222RN       5.2E-01   5.6E-02  PCI/
25 0240 077 05 8 97      2
134758 ODR08 014         ON- 09 23 74 0905
  SIZE-                 OFF- 09 25 74 0900

GRAND JCT COLO                                  222RN       7.5E-01   6.6E-02  PCI/L
25 0240 077 05 8 97      2
135145 ODR09 014         ON- 10 15 74 1000
  SIZE-                 OFF- 10 17 74 0940

GRAND JCT COLO                                  222RN       8.5E-01   7.2E-02  PCI/L
25 0240 077 05 8 97      2
135490 ODR10 014         ON- 11 04 74 0915
  SIZE-                 OFF- 11 06 74 0920

GRAND JCT COLO                                  222RN       1.9E00    1.1E-01  PCI/L
25 0240 077 05 8 97      2
141016 ODR11 014         ON- 11 24 74 0905
  SIZE-                 OFF- 11 26 74 1040

GRAND JCT COLO                                  222RN       1.2E00    8.2E-02  PCI/L
25 0240 077 05 8 97      2
141414 ODR12 014         ON- 12 31 74 1015
  SIZE-                 OFF- 01 02 75 1015

GRAND JCT COLO                                  222RN       1.0E00    8.0E-02  PCI/L
25 0240 077 05 8 97      2
141714 ODR13 014         ON- 01 07 75 0940
  SIZE-                 OFF- 01 09 75 0910

GRAND JCT COLO                                  222RN       5.3E-01   6.2E-02  PCI/L
25 0240 077 05 8 97      2
142314 ODR14 014         ON- 01 27 75 0930
  SIZE-                 OFF- 01 29 75 0925

GRAND JCT COLO                                  222RN       8.9E-01   7.4E-02  PCI/L
25 0240 077 05 8 97      2
142914 ODR15 014         ON- 02 18 75 0935
  SIZE-                 OFF- 02 20 75 1000

GRAND JCT COLO                                  NOSAMPLE
25 0240 077 05 8 97
145971 ODR16 014         ON- 03 10 75 1010
  SIZE-                 OFF- 03 12 75 0940
```

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GRAND JCT COLORADO 222RN RESULTS

COLORADO                    REPORTED  75/07/08
--------------------------------------------------ANALYSIS---RESULT----2SIGMA---UNITS

GRAND JCT COLO                                        222RN      4.9E-01   6.0E-02  PCI/L
25 0240 077 05 8 97     2
143214 ODR16 014          ON- 03 17 75 1035
  SIZE-                  OFF- 03 19 75 1145

GRAND JCT COLO                                        222RN      5.2E-01   5.6E-02  PCI/L
25 0240 077 05 8 97     2
144014 ODR17 014          ON- 03 31 75 1005
  SIZE-                  OFF- 04 02 75 0950

GRAND JCT COLO                                        222RN      9.0E-01   7.4E-02  PCI/L
25 0240 077 05 8 97     2
130648 ODR01 015          ON- 04 29 74 1510
  SIZE-                  OFF- 05 01 74 1035

GRAND JCT COLO                                        222RN      5.1E-01   5.6E-02  PCI/L
25 0240 077 05 8 97     2
131583 ODR02 015          ON- 05 21 74 1450
  SIZE-                  OFF- 05 23 74 1350

GRAND JCT COLO                                        222RN      5.6E-01   5.8E-02  PCI/L
25 0240 077 05 8 97     2
131958 ODR03 015          ON- 06 10 74 1230
  SIZE-                  OFF- 06 12 74 0920

GRAND JCT COLO                                        222RN      4.6E-01   6.4E-02  PCI/L
25 0240 077 05 8 97     2
132588 ODR04 015          ON- 06 30 74 1330
  SIZE-                  OFF- 07 02 74 0955

GRAND JCT COLO                                        222RN      4.6E-01   5.3E-02  PCI/L
25 0240 077 05 8 97     2
133239 ODR05 015          ON- 07 24 74 1035
  SIZE-                  OFF- 07 26 74 1325

GRAND JCT COLO                                        222RN      5.5E-01   6.6E-02  PCI/L
25 0240 077 05 8 97     2
133666 ODR06 015          ON- 08 12 74 0930
  SIZE-                  OFF- 08 14 74 0800

GRAND JCT COLO                                        NO-SAMPLE
25 0240 077 05 8 97     2
134199 ODR07 015          ON- 09 03 74 0850
  SIZE-                  OFF- 09 05 74 0845

GRAND JCT COLO                                        222RN      3.5E-01   4.6E-02  PCI/L
25 0240 077 05 8 97     2
134343 ODR07 015          ON- 09 09 74 1333
  SIZE-                  OFF- 09 11 74 1101
```

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GRAND JCT COLORADO 222RN RESULTS

COLORADO                  REPORTED  75/07/08
========================================ANALYSIS---RESULT----2SIGMA---UNITS

GRAND JCT COLO                              222RN      5.3E-01   5.7E-02  PCI/L
25 0240 077 05 8 97     2
134759 ODR08 015       ON- 09 23 74 1248
  SIZE-                OFF- 09 25 74 1040

GRAND JCT COLO                              222RN      6.6E-01   5.8E-02  PCI/L
25 0240 077 05 8 97     2
135152 ODR09 015       ON- 10 21 74 0935
  SIZE-                OFF- 10 23 74 1025

GRAND JCT COLO                              222RN      1.3E00    9.1E-02  PCI/L
25 0240 077 05 8 97     2
135493 ODR10 015       ON- 11 11 74 0945
  SIZE-                OFF- 11 13 74 1010

GRAND JCT COLO                              222RN      4.4E-02   1.9E-02  PCI/L
25 0240 077 05 8 97     2
141017 ODR11 015       ON- 11 24 74 1030
  SIZE-                OFF- 11 26 74 1050

GRAND JCT COLO                              222RN      9.0E-01   7.3E-02  PCI/L
25 0240 077 05 8 97     2
141415 ODR12 015       ON- 12 31 74 1030
  SIZE-                OFF- 01 02 75 1030

GRAND JCT COLO                              NOSAMPLE
25 0240 077 05 8 97     2
141715 ODR13 015       ON- 01 27 75 1225
  SIZE-                OFF- 01 29 75 1045

GRAND JCT COLO                              222RN      5.6E-01   5.8E-02  PCI/L
25 0240 077 05 8 97     2
142315 ODR14 015       ON- 02 03 75 1010
  SIZE-                OFF- 02 05 75 1015

GRAND JCT COLO                              222RN      7.0E-01   6.7E-02  PCI/L
25 0240 077 05 8 97     2
142915 ODR15 015       ON- 02 18 75 1230
  SIZE-                OFF- 02 20 75 1025

GRAND JCT COLO                              222RN      4.4E-01   5.2E-02  PCI/L
25 0240 077 05 8 97     2
143215 ODR16 015       ON- 03 10 75 1325
  SIZE-                OFF- 03 12 75 1110

GRAND JCT COLO                              222RN      4.6E-01   5.9E-02  PCI/L
25 0240 077 05 8 97     2
144015 ODR17 015       ON- 03 29 75 1225
  SIZE-                OFF- 03 31 75 0935
```

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GRAND JCT COLORADO 222RN RESULTS

COLORADO                    REPORTED  75/07/08
---------------------------------------------ANALYSIS---RESULT----2SIGMA---UNITS

GRAND JCT COLO                                    222RN       1.4E00     9.1E-02  PCI/L
25 0240 077 05 8 97      2
130649 ODR01 016          ON- 04 29 74 1020
  SIZE-                  OFF- 05 01 74 0950

GRAND JCT COLO                                    222RN       1.8E00     1.0E-01  PCI/L
25 0240 077 05 8 97      2
131584 ODR02 016          ON- 05 21 74 1420
  SIZE-                  OFF- 05 23 74 1330

GRAND JCT COLO                                    222RN       9.0E-01    7.5E-02  PCI/L
25 0240 077 05 8 97      2
131959 ODR03 016          ON- 06 10 74 1255
  SIZE-                  OFF- 06 12 74 0945

GRAND JCT COLO                                    222RN       5.4E-01    6.9E-02  PCI/L
25 0240 077 05 8 97      2
132589 ODR04 016          ON- 06 30 74 1245
  SIZE-                  OFF- 07 02 74 1015

GRAND JCT                                         222RN       4.5E-01    5.2E-02  PCI/L
25 0240 077 05 8 97      2
133231 ODR05 016          ON- 07 22 74 1045
  SIZE-                  OFF- 07 24 74 1145

GRAND JCT COLO                                    222RN       7.4E-01    6.8E-02  PCI/L
25 0240 077 05 8 97      2
133667 ODR06 016          ON- 08 12 74 0945
  SIZE-                  OFF- 08 14 74 0815

GRAND JCT COLO                                    222RN       1.1E00     8.1E-02  PCI/L
25 0240 077 05 8 97      2
134200 ODR07 016          ON- 09 03 74 0910
  SIZE-                  OFF- 09 05 74 0905

GRAND JCT COLO                                    222RN       8.6E-01    7.4E-02  PCI/L
25 0240 077 05 8 97      2
134760 ODR08 016          ON- 09 23 74 0930
  SIZE-                  OFF- 09 25 74 0915

GRAND JCT COLO                                    222RN       1.8E00     1.0E-01  PCI/L
25 0240 077 05 8 97      2
135146 ODR09 016          ON- 10 15 74 0935
  SIZE-                  OFF- 10 17 74 0930

GRAND JCT COLO                                    222RN       2.7E00     1.3E-01  PCI/L
25 0240 077 05 8 97      2
135494 ODR10 016          ON- 11 11 74 0955
  SIZE-                  OFF- 11 13 74 1040
```

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GRAND JCT COLORADO 222RN RESULTS

COLORADO                    REPORTED  75/07/08
--------------------------------------------ANALYSIS---RESULT----2SIGMA---UNITS

GRAND JCT COLO                              222RN        3.0E00    1.4E-01  PCI/L
25 0240 077 05 8 97      2
141018 ODR11 016          ON- 12 02 74 1000
  SIZE-                  OFF- 12 04 74 1150

GRAND JCT COLO                              222RN        1.2E00    8.7E-02  PCI/L
25 0240 077 05 8 97      2
141416 ODR12 016          ON- 12 31 74 1010
  SIZE-                  OFF- 01 02 75 1010

GRAND JCT COLO                              SAMPLE-LOST
25 0240 077 05 8 97      2
141716 ODR13 016          ON- 01 07 75 0945
  SIZE-                  OFF- 01 09 75 0920

GRAND JCT COLO                              222RN        1.4E-01   2.9E-02  PCI/L
25 0240 077 05 8 97      2
141921 ODR13 016          ON- 01 14 75 1025
  SIZE-                  OFF- 01 16 75 1020

GRAND JCT COLO                              222RN        1.1E00    8.3E-02  PCI/L
25 0240 077 05 8 97      2
142316 ODR14 016          ON- 01 27 75 0950
  SIZE-                  OFF- 01 29 75 0935

GRAND JCT COLO                              222RN        8.4E-01   7.1E-02  PCI/L
25 0240 077 05 8 97      2
142916 ODR15 016          ON- 02 18 75 0920
  SIZE-                  OFF- 02 20 75 1005

GRAND JCT COLO                              222RN        5.5E-01   6.0E-02  PCI/L
25 0240 077 05 8 97      2
143216 ODR16 016          ON- 03 10 75 1025
  SIZE-                  OFF- 03 12 75 0950

GRAND JCT COLO                              222RN        2.0E-01   3.8E-02  PCI/L
25 0240 077 05 8 97      2
144016 ODR17 016          ON- 03 31 75 0950
  SIZE-                  OFF- 04 02 75 0955

GRAND JCT COLO                              222RN        3.7E00    1.5E-01  PCI/L
25 0240 077 05 8 97      2
130650 ODR01 017          ON- 04 29 74 1115
  SIZE-                  OFF- 05 01 74 1008

GRAND JCT COLO                              222RN        6.0E00    1.2E00   PCI/L
25 0240 077 05 8 97      2
131585 ODR02 017          ON- 05 21 74 1430
  SIZE-                  OFF- 05 23 74 1335
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GRAND JCT COLORADO 222RN RESULTS

COLORADO                  REPORTED  75/07/08
--------------------------------------ANALYSIS---RESULT----2SIGMA---UNITS

GRAND JCT COLO                                222RN      3.1E00    1.4E-01  PCI/L
25 0240 077 05 8 97     2
131960 ODR03 017        ON- 06 10 74 1115
  SIZE-                OFF- 06 12 74 0935

GRAND JCT COLO                                222RN      2.6E00    1.5E-01  PCI/L
25 0240 077 05 8 97     2
132590 ODR04 017        ON- 06 30 74 1250
  SIZE-                OFF- 07 02 74 1010

GRAND JCT COLO                                222RN      1.2E00    8.5E-02  PCI/L
25 0240 077 05 8 97     2
133224 ODR05 017        ON- 07 22 74 1035
  SIZE-                OFF- 07 24 74 1120

GRAND JCT COLO                                222RN      2.4E00    1.4E-01  PCI/L
25 0240 077 05 8 97     2
133668 ODR06 017        ON- 08 12 74 1025
  SIZE-                OFF- 08 14 74 0830

GRAND JCT COLO                                222RN      2.2E00    1.2E-01  PCI/L
25 0240 077 05 8 97     2
134344 ODR07 017        ON- 09 09 74 0946
  SIZE-                OFF- 09 11 74 0856

GRAND JCT COLO                                222RN      4.0E00    1.6E-01  PCI/L
25 0240 077 05 8 97     2
134761 ODR08 017        ON- 09 23 74 1042
  SIZE-                OFF- 09 25 74 0920

GRAND JCT COLO                                222RN      3.3E00    1.3E-01  PCI/L
25 0240 077 05 8 97     2
135153 ODR09 017        ON- 10 21 74 0950
  SIZE-                OFF- 10 23 74 1035

GRAND JCT COLO                                222RN      5.2E00    1.8E-01  PCI/L
25 0240 077 05 8 97     2
135495 ODR10 017        ON- 11 11 74 1005
  SIZE-                OFF- 11 13 74 1045

GRAND JCT COLO                                222RN      7.6E00    1.4E00   PCI/L
25 0240 077 05 8 97     2
141019 ODR11 017        ON- 11 24 74 1045
  SIZE-                OFF- 11 26 74 1020

GRAND JCT COLO                                NOSAMPLE
25 0240 077 05 8 97     2
141417 ODR12 017        ON- 12 31 74 1005
  SIZE-                OFF- 01 02 75 1000
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GRAND JCT COLORADO 222RN RESULTS

COLORADO                  REPORTED  75/07/08
------------------------------------------------ANALYSIS---RESULT----2SIGMA---UNITS

GRAND JCT COLO                                 222RN      1.2E00     8.8E-02  PCI/L
25 0240 077 05 8 97      2
141717 ODR13 017          ON- 01 07 75 0955
  SIZE-                  OFF- 01 09 75 0925

GRAND JCT COLO                                 222RN      1.4E00     9.8E-02  PCI/L
25 0240 077 05 8 97      2
142317 ODR14 017          ON- 01 27 75 1040
  SIZE-                  OFF- 01 29 75 0940

GRAND JCT COLO                                 222RN      2.1E00     1.1E-01  PCI/L
25 0240 077 05 8 97      2
142917 ODR15 017          ON- 02 18 75 1215
  SIZE-                  OFF- 02 20 75 1010

GRAND JCT COLO                                 222RN      1.1E00     9.1E-02  PCI/L
25 0240 077 05 8 97      2
143217 ODR16 017          ON- 03 10 75 1200
  SIZE-                  OFF- 03 12 75 0955

GRAND JCT COLO                                 222RN      1.0E00     8.1E-02  PCI/L
25 0240 077 05 8 97      2
144017 ODR17 017          ON- 03 31 75 1025
  SIZE-                  OFF- 04 02 75 1000

GRAND JCT COLO                                 222RN      5.0E-01    5.5E-02  PCI/L
25 0240 077 05 8 97      2
131586 ODR02 018          ON- 05 21 74 1445
  SIZE-                  OFF- 05 23 74 1125

GRAND JCT COLO                                 222RN      8.2E-01    7.3E-02  PCI/L
25 0240 077 05 8 97      2
131961 ODR03 018          ON- 06 10 74 1340
  SIZE-                  OFF- 06 12 74 1025

GRAND JCT COLO                                 222RN      7.0E-01    6.5E-02  PCI/L
25 0240 077 05 8 97      2
132937 ODR04 018          ON- 07 08 74 1535
  SIZE-                  OFF- 07 10 74 1410

GRAND JCT COLO                                 222RN      4.8E-01    5.4E-02  PCI/L
25 0240 077 05 8 97      2
133246 ODR05 018          ON- 07 24 74 1200
  SIZE-                  OFF- 07 26 74 1340

GRAND JCT COLO                                 222RN      5.0E-01    5.6E-02  PCI/L
25 0240 077 05 8 97      2
133669 ODR06 018          ON- 08 12 74 1355
  SIZE-                  OFF- 08 14 74 0915
```

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GRAND JCT COLORADO 222RN RESULTS

COLORADO                  REPORTED  75/07/08
--------------------------------------------ANALYSIS---RESULT----2SIGMA---UNITS-

GRAND JCT COLO                                222RN       9.2E-01   7.5E-02  PCI/L
25 0240 077 05 8 97      2
134345 ODR07 018        ON- 09 09 74 1058
  SIZE-                OFF- 09 11 74 0947

GRAND JCT COLO                                222RN       5.4E-01   5.8E-02  PCI/L
25 0240 077 05 8 97      2
134947 ODR08 018        ON- 09 30 74 1025
  SIZE-                OFF- 10 02 74 1025

GRAND JCT COLO                                222RN       9.6E-01   7.7E-02  PCI/L
25 0240 077 05 8 97      2
135147 ODR09 018        ON- 10 15 74 1130
  SIZE-                OFF- 10 17 74 1020

GRAND JCT COLO                                222RN       1.2E00    8.8E-02  PCI/L
25 0240 077 05 8 97      2
135491 ODR10 018        ON- 11 04 74 1245
  SIZE-                OFF- 11 06 74 1005

GRAND JCT COLO                                222RN       2.7E00    1.3E-01  PCI/L
25 0240 077 05 8 97      2
141020 ODR11 018        ON- 12 02 74 1010
  SIZE-                OFF- 12 04 74 1155

GRAND JCT COLO                                222RN       1.1E00    8.2E-02  PCI/L
25 0240 077 05 8 97      2
141418 ODR12 018        ON- 12 31 74 0920
  SIZE-                OFF- 01 02 75 0925

GRAND JCT COLO                                222RN       9.4E-01   7.6E-02  PCI/L
25 0240 077 05 8 97      2
141718 ODR13 018        ON- 01 07 75 1005
  SIZE-                OFF- 01 09 75 1000

GRAND JCT COLO                                222RN       4.0E-01   5.5E-02  PCI/L
25 0240 077 05 8 97      2
142318 ODR14 018        ON- 01 27 75 1105
  SIZE-                OFF- 01 29 75 0950

GRAND JCT COLO                                222RN       8.0E-01   6.9E-02  PCI/L
25 0240 077 05 8 97      2
142918 ODR15 018        ON- 02 18 75 1010
  SIZE-                OFF- 02 20 75 1100

GRAND JCT COLO                                222RN       3.3E-01   4.9E-02  PCI/L
25 0240 077 05 8 97      2
143218 ODR16 018        ON- 03 10 75 1130
  SIZE-                OFF- 03 12 75 1040
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GRAND JCT COLORADO 222RN RESULTS

COLORADO                    REPORTED  75/07/08
-------------------------------------------------ANALYSIS---RESULT----2SIGMA---UNITS

GRAND JCT COLO                                      222RN       2.7E-01   4.5E-02  PCI/L
25 0240 077 05 8 97     2
144018 ODR17 018         ON- 03 31 75 1210
  SIZE-                 OFF- 04 02 75 1100

GRAND JCT COLO                                      222RN       6.7E-01   6.5E-02  PCI/L
25 0240 077 05 8 97     2
130651 ODR01 019         ON- 04 29 74 1328
  SIZE-                 OFF- 05 01 74 1130

GRAND JCT COLO                                      222RN       3.6E-02   1.7E-02  PCI/L
25 0240 077 05 8 97     2
131587 ODR02 019         ON- 05 21 74 1510
  SIZE-                 OFF- 05 23 74 1117

GRAND JCT COLO                                      222RN       4.3E-01   5.2E-02  PCI/L
25 0240 077 05 8 97     2
132395 ODR03 019         ON- 06 24 74 1550
  SIZE-                 OFF- 06 26 74 1125

GRAND JCT COLO                                      222RN       3.4E-01   5.6E-02  PCI/L
25 0240 077 05 8 97     2
132591 ODR04 019         ON- 06 30 74 1550
  SIZE-                 OFF- 07 02 74 1315

GRAND JCT COLO                                      222RN       4.5E-01   5.3E-02  PCI/L
25 0240 077 05 8 97     2
133241 ODR05 019         ON- 07 24 74 1310
  SIZE-                 OFF- 07 26 74 1350

GRAND JCT COLO                                      222RN       3.9E-01   5.0E-02  PCI/L
25 0240 077 05 8 97     2
133670 ODR06 019         ON- 08 12 74 1410
  SIZE-                 OFF- 08 14 74 0935

GRAND JCT COLO                                      222RN       6.7E-01   6.4E-02  PCI/L
25 0240 077 05 8 97     2
134201 ODR07 019         ON- 09 03 74 1135
  SIZE-                 OFF- 09 05 74 1035

GRAND JCT COLO                                      222RN       8.9E-01   8.0E-02  PCI/L
25 0240 077 05 8 97     2
134762 ODR08 019         ON- 09 23 74 1155
  SIZE-                 OFF- 09 25 74 0955

GRAND JCT COLO                                      222RN       9.6E-01   7.7E-02  PCI/L
25 0240 077 05 8 97     2
135148 ODR09 019         ON- 10 15 74 1210
  SIZE-                 OFF- 10 17 74 1030
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GRAND JCT COLORADO 222RN RESULTS

COLORADO                  REPORTED  75/07/08
---------------------------------------------ANALYSIS---RESULT----2SIGMA---UNITS

GRAND JCT COLO                                222RN       4.3E-01   5.2E-02  PCI/L
25 0240 077 05 8 97      2
135492 ODR10 019         ON-  11 04 74 1145
  SIZE-                  OFF- 11 06 74 1000

GRAND JCT COLO                                222RN       1.2E00    8.5E-02  PCI/L
25 0240 077 05 8 97      2
141021 ODR11 019         ON-  11 24 74 1125
  SIZE-                  OFF- 11 26 74 1005

GRAND JCT COLO                                222RN       8.4E-01   7.2E-02  PCI/L
25 0240 077 05 8 97      2
141419 ODR12 019         ON-  12 31 74 0925
  SIZE-                  OFF- 01 02 75 0915

GRAND JCT COLO                                222RN       9.7E-01   7.8E-02  PCI/L
25 0240 077 05 8 97      2
141719 ODR13 019         ON-  01 07 75 1020
  SIZE-                  OFF- 01 09 75 0950

GRAND JCT COLO                                222RN       6.3E-01   6.8E-02  PCI/L
25 0240 077 05 8 97      2
142319 ODR14 019         ON-  01 27 75 1125
  SIZE-                  OFF- 01 29 75 1010

GRAND JCT COLO                                222RN       6.7E-01   6.4E-02  PCI/L
25 0240 077 05 8 97      2
142919 ODR15 019         ON-  02 18 75 1025
  SIZE-                  OFF- 02 20 75 1050

GRAND JCT COLO                                222RN       4.9E-01   5.5E-02  PCI/L
25 0240 077 05 8 97      2
143219 ODR16 019         ON-  03 10 75 1100
  SIZE-                  OFF- 03 12 75 1030

GRAND JCT COLO                                222RN       4.6E-01   5.5E-02  PCI/L
25 0240 077 05 8 97      2
144019 ODR17 019         ON-  03 31 75 1150
  SIZE-                  OFF- 04 02 75 1055

GRAND JCT COLO                                222RN       9.3E-01   7.7E-02  PCI/L
25 0240 077 05 8 97      2
130652 ODR01 020         ON-  04 29 74 1318
  SIZE-                  OFF- 05 01 74 1120

GRAND JCT COLO                                222RN       5.7E-01   6.0E-02  PCI/L
25 0240 077 05 8 97      2
131588 ODR02 020         ON-  05 21 74 1525
  SIZE-                  OFF- 05 23 74 1105
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GRAND JCT COLORADO 222RN RESULTS

COLORADO                    REPORTED  75/07/08
------------------------------------------------ANALYSIS---RESULT----2SIGMA---UNI
GRAND JCT COLO                                   222RN        5.4E-01   5.8E-02  PCI/
25 0240 077 05 8 97     2
131962 ODR03 020         ON- 06 10 74 1645
  SIZE-                 OFF- 06 12 74 1045

GRAND JCT COLO                                   222RN        3.1E-01   5.3E-02  PCI/
25 0240 077 05 8 97     2
132592 ODR04 020         ON- 06 30 74 1605
  SIZE-                 OFF- 07 02 74 1340

GRAND JCT COLO                                   222RN        3.6E-01   4.6E-02  PCI/
25 0240 077 05 8 97     2
133235 ODR05 020         ON- 07 24 74 1320
  SIZE-                 OFF- 07 26 74 1400

GRAND JCT COLO                                   222RN        5.0E-01   5.7E-02  PCI/
25 0240 077 05 8 97     2
133671 ODR06 020         ON- 08 12 74 1425
  SIZE-                 OFF- 08 14 74 0945

GRAND JCT COLO                                   NO-SAMPLE
25 0240 077 05 8 97     2
134202 ODR07 020         ON- 09 03 74 1145
  SIZE-                 OFF- 09 05 74 1045

GRAND JCT COLO                                   222RN        4.9E-01   6.0E-02  PCI/
25 0240 077 05 8 97     2
134763 ODR08 020         ON- 09 23 74 1140
  SIZE-                 OFF- 09 25 74 0945

GRAND JCT COLO                                   222RN        5.6E-01   5.4E-02  PCI/
25 0240 077 05 8 97     2
135154 ODR09 020         ON- 10 21 74 1050
  SIZE-                 OFF- 10 23 74 1120

GRAND JCT COLO                                   222RN        1.1E00    8.5E-02  PCI/
25 0240 077 05 8 97     2
135496 ODR10 020         ON- 11 11 74 1025
  SIZE-                 OFF- 11 13 74 1110

GRAND JCT COLO                                   222RN        1.1E00    8.4E-02  PCI/
25 0240 077 05 8 97     2
141022 ODR11 020         ON- 11 24 74 1115
  SIZE-                 OFF- 11 26 74 0955

GRAND JCT COLO                                   222RN        6.2E-01   6.3E-02  PCI/
25 0240 077 05 8 97     2
141720 ODR13 020         ON- 01 07 75 1015
  SIZE-                 OFF- 01 09 75 0940
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GRAND JCT COLORADO 222RN RESULTS

COLORADO                    REPORTED  75/07/08
---------------------------------------------ANALYSIS---RESULT----2SIGMA---UNITS

GRAND JCT COLO                                222RN       4.3E-01   5.2E-02  PCI/L
25 0240 077 05 8 97     2
142320 ODR14 020        ON- 01 27 75 1120
  SIZE-                OFF- 01 29 75 1000

GRAND JCT COLO                                222RN       6.7E-01   6.3E-02  PCI/L
25 0240 077 05 8 97     2
142920 ODR15 020        ON- 02 18 75 1035
  SIZE-                OFF- 02 20 75 1045

GRAND JCT COLO                                222RN       6.0E-01   6.2E-02  PCI/L
25 0240 077 05 8 97     2
143220 ODR1[illegible] 020        ON- 03 17 75 1150
  SIZE-                OFF- 03 19 75 0920

GRAND JCT COLO                                222RN       3.9E-01   5.4E-02  PCI/L
25 0240 077 05 8 97     2
144020 ODR17 020        ON- 03 31 75 1140
  SIZE-                OFF- 04 02 75 1045
```